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May Cunningham  
Feb 2<sup>nd</sup> 1905.

~~Camoy's~~ ~~Tran tree.~~

St Martin's, Radlett, Herts.

HANDBOOK  
OF  
BRITISH MOSSES.



HANDBOOK  
OF  
BRITISH MOSSES;

COMPRISING  
ALL THAT ARE KNOWN TO BE NATIVES

OF  
*The British Isles.*

BY THE  
REV. M. J. BERKELEY, M.A., F.L.S.,

AUTHOR OF 'INTRODUCTION TO CRYPTOGAMIC BOTANY,'  
'OUTLINES OF BRITISH FUNGOLOGY,' ETC.



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LINCOLN'S INN FIELDS.



TO  
THE MOST HONOURABLE  
MARY ANTOINETTA, MARCHIONESS OF HUNTLY,

*This Work is Inscribed*

WITH EVERY FEELING OF ESTEEM AND RESPECT

BY

HER GRATEFUL AND HUMBLE SERVANT,

THE AUTHOR.

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## PREFACE.



THIS Work is to be regarded as one of a series of Manuals of different branches of Botany, and not as a separate publication. It is by no means the wish or intention of the Author or Publisher, to offer it to the public in any spirit of opposition to the excellent author of the 'Bryologia Britannica.' On the contrary, it is hoped that it may be the means of calling the attention of many to his volume, of which it is impossible to speak in too favourable terms, as the slight sketch here presented may excite a wish to apply to the fountain-head for fuller information.

As regards the execution, I can only say that every species of which I could obtain specimens has been carefully reviewed under the microscope; and as I had, through the kindness of Sir W. J. Hooker, unlimited access to the unrivalled collection in Kew, which, amidst a multitude of other authentic specimens, contains almost a complete series of those described by Mr. Wilson, there are very few species which I have been obliged to leave unexamined. I have quoted Mr. Wilson's

book throughout as "Hooker and Wilson," since the name of Sir William still remains on the title-page, but it is to be understood distinctly that the whole was prepared by Mr. Wilson. The figures are from the pencil of Mr. Fitch, with the exception of the magnified leaves, and the details of fructification, for which I am myself answerable. The Work does not lay any claim to originality, but I have spared no pains to make it accurate. My best thanks are due to Sir W. J. Hooker for the assistance he has afforded, without which the volume could not have appeared, and to other kind friends who have helped me with specimens and information during the course of its preparation.

KING'S CLIFFE,  
*May, 1863.*

## EXPLANATION OF THE PLATES.



### PLATE I.

Fig. 1. Prothallus of *Sphagnum cuspidatum* (after Hofmeister).

Fig. 2. Archegonium of *Phascum*, showing the embryonic cell with its nucleus just after impregnation, magnified (after Hofmeister).

Fig. 3. Antheridium and paraphyses of *Mnium punctatum*, magnified. The antheridium is ejecting the spermatozoids.

Fig. 4. Antheridium of *Sphagnum* (after Hofmeister).

Fig. 5. Perforated leaf-cells of *Sphagnum*, containing a spiral thread, and surrounded by narrow chlorophyllous cells, magnified.

Fig. 6. Perforated cells of *Leucobryum glaucum*, enclosing chlorophyllous cells.

Fig. 7. Section of upper part of sporangium of *Phascum cuspidatum*, magnified (after Lantzius-Beninga).

*c.* columella.

*s.* spore-sac.

*a.* walls of spore-sac.

*i.* intermediate space.

*m.* inner wall of intermediate space.

*k.* outer wall of intermediate space.

*w.* wall of sporangium.

Fig. 8. Section of upper part of sporangium of *Bartramia fontana*, magnified (after Lantzius-Beninga).

*c.* columella.

*s.* spore-sac.

*a.* outer wall of spore-sac.

*i.* intermediate space, traversed with threads.

*m.* inner wall of intermediate space.

*k.* outer wall of intermediate space.

*l.* row of cells continued from *m.*

*g.* row of cells continued from top of intermediate space.

*d.* inner peristome, formed from the thickening of the outer wall of the cells in *l* and the inner wall of the cells in *g*.

*h.* row of cells continued from outer wall of intermediate space.

*b.* outer peristome, formed by the thickening of the outer wall of the cells in *g* and of the inner wall of the cells in *h*.

## PLATE II.

### 1. *Sphagnum cymbifolium*.

*a.* plant, nat. size.

*b.* cells from stem, magnified.

*c.* leaf, magnified.

*d.* sporangium.

### 2. *S. compactum*.

*a.* plant, nat. size.

*b.* cells from stem, magnified.

*c.* leaf, magnified.

*d.* sporangium.

### 3. *S. molluscum*.

*a.* plant, nat. size.

*b.* cells from stem, magnified.

*c.* leaf, magnified.

4. *S. acutifolium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with remains of veil, magnified.
  - d.* lid, magnified.
5. *S. squarrosum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with remains of veil, magnified.
6. *Andreæa alpina*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* portion of leaves, magnified.
  - d.* young sporangium, magnified.
  - e.* sporangium ruptured, magnified.
7. *A. rupestris*.
  - a.* plant, nat. size.
  - b, c.* leaves, magnified.
  - d.* sporangium, magnified.

## PLATE III.

1. *Fontinalis squamosa*.
  - a.* leaf, magnified.
  - b.* sporangium with perichætium, magnified.
  - c.* portion of outer and inner peristome, magnified.
2. *F. antipyretica*.
  - a.* leaf, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium with perichætium, magnified.
  - d.* veil, magnified.
  - e.* sporangium with peristome, magnified.
3. *Cryphæa heteromalla*.
  - a.* leaf, magnified.

- b.* leaf-cells, magnified.
- c.* sporangium with perichætium, magnified.
- d.* veil, magnified.
- 4. *Daltonia splachnoides.*
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
  - d.* part of peristome, magnified.
- 5. *Hookeria lucens.*
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
  - d.* part of peristome, magnified.
- 6. *H. læte-virens.*
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

## PLATE IV.

- 1. *Neckera complanata.*
  - a.* leaves, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium, magnified.
  - d.* veil, magnified.
- 2. *N. crispa.*
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
- 3. *N. pumila.*
  - a.* leaf magnified.
  - b.* sporangium magnified.
  - c.* part of peristome, magnified, seen from within.
- 4. *N. pennata.*
  - a.* leaf, magnified.
  - b.* sporangium, magnified, with perichætium.



5. *Homalia trichomanoides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
6. *Hypnum nitens*.
  - a.* rootlets, magnified.
  - b.* tip of one more highly magnified.
  - c.* leaves, magnified.
  - d.* sporangium, magnified.

## PLATE V.

1. *Hypnum albicans*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* lid, magnified.
2. *H. lutescens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. plumosum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
4. *H. velutinum*.
  - a.* leaf, magnified.
  - b.* sporangium, with peristome, magnified.
  - c.* sporangium, with lid, magnified.
5. *H. rutabulum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* part of peristome, magnified.
  - d.* ring, magnified.
6. *H. rivulare*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

## PLATE VI.

1. *Hypnum ruscifolium*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. murale*.
  - a.* leaf, magnified.
  - b.* young veil, magnified.
  - c.* sporangium, magnified.
3. *H. riparium*.
  - a.* leaf magnified.
  - b.* sporangium, magnified.
  - c.* male inflorescence, magnified.
  - d.* antheridium, magnified.
4. *H. polygamum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *H. chrysophyllum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
6. *H. stellatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

## PLATE VII.

1. *Hypnum palustre*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
2. *H. molle*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
3. *H. arcticum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

4. *H. stramineum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *H. trifarium*.
  - a.* leaves, magnified.
6. *H. cordifolium*.
  - a.* leaves, magnified.
  - b.* young veil, magnified.
  - c.* sporangium, magnified.

## PLATE VIII.

1. *Hypnum cuspidatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. Schreberi*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
3. *H. purum*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
4. *Thuidium tamariscinum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *Hypnum Blandovii*.
  - a.* leaf, magnified.
  - b.* leaf, seen from behind, with down-like paraphylla.
  - c.* sporangium, magnified.

## PLATE IX.

1. *Hypnum splendens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

2. *H. brevirostre*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
3. *H. triquetrum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. loreum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *H. flagellare*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.

## PLATE X.

1. *Hypnum squarrosum* (a procumbent form).
  - a.* leaf from behind, magnified.
  - b.* sporangium, magnified.
2. *H. aduncum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
3. *H. fluitans*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. revolvens*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *H. commutatum*.
  - a.* leaf from behind, magnified.
  - b.* sporangium, magnified.
6. *H. filicinum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.

## PLATE XI.

1. *Hypnum uncinatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. Crista-castrensis*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. molluscum* (different from the usual habit).
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. cupressiforme*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *H. scorpioides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* male inflorescence, magnified.
6. *H. demissum*.
  - a.* leaves from before and behind, magnified.
  - b.* sporangium, magnified.

## PLATE XII.

1. *Hypnum pulchellum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
2. *H. denticulatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. elegans*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

4. *H. undulatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *Pylaisia polyantha*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
6. *Homalothecium sericeum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.

## PLATE XIII.

1. *Thamnum alopecurum*.
  - a.* leaf, magnified.
  - b.* veil, magnified.
  - c.* sporangium, magnified.
2. *Climacium dendroides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
3. *Leucodon sciuroides*.
  - a.* leaves, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome with ring, magnified.
4. *Antitrichia curtipendula*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
  - d.* portion of inner peristome, more highly magnified.
5. *Leptodon Smithii*.
  - a.* leaves, magnified.
  - b.* veil, magnified.

- c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
6. *Anomodon viticulosum*.
- a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome seen from within, magnified.

## PLATE XIV.

1. *Anœctangium compactum*.
- a.* sporangium, magnified.
  - b.* sporangium after lid has fallen.
  - c.* leaf, magnified.
  - d.* leaf-cells, magnified.
2. *Fissidens adiantoides*.
- a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
3. *F. taxoides*.
- a.* leaf, magnified.
  - b.* sporangium, magnified.
4. *Schistostega osmundacea*.
- a.* plant, magnified.
  - b.* part more highly magnified.
  - c.* lid, magnified.
5. *Ædipodium Griffithii*.
- a.* leaf, magnified.
  - b.* sporangium, magnified.
6. *Dissodon splachnoides*.
- a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
7. *Tayloria serrata*.
- a.* leaf, magnified.

- b.* young veil, magnified.
- c.* sporangium, magnified.
- d.* sporangium, when dry.
- e.* portion of peristome, magnified.

## PLATE XV.

1. *Tetraplodon angustatus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium without lid, magnified.
2. *T. mnioides*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, magnified.
  - d.* sporangium without lid.
  - e.* portion of peristome, magnified.
3. *Splachnum sphæricum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, magnified.
  - d.* sporangium without lid.
4. *S. ampullaceum*.
  - a.* plant, male and female, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
5. *S. vasculosum*.
  - a.* plant, male and female, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, magnified.
  - d.* sporangium without lid.



6. *Discelium nudum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* peristome with ring and spores, magnified.
7. *Catoscopium nigratum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
8. *Conostomum boreale*.
  - a.* plant, nat. size.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
  - d.* portion of one of the teeth, magnified.
  - e.* leaf, magnified.

## PLATE XVI.

1. *Bartramia ithyphylla*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *B. pomiformis*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells and margin, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
3. *B. Oederi*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.

4. *B. calcarea*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of inner peristome of *B. fontana*, magnified.
5. *Entosthodon Templetoni*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
6. *Funaria hygrometrica*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of outer peristome, magnified.
  - e.* portion of inner peristome.
7. *Meesia uliginosa*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* spore, magnified.

## PLATE XVII.

1. *Cinclidium stygium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *Mnium affine*.
  - a.* female plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* male plant, nat. size.

3. *M. cuspidatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *M. undulatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
5. *M. rostratum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
6. *M. punctatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
7. *Amblyodon dealbatus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* portion of inner peristome, more highly magnified.

## PLATE XVIII.

1. *Zieria julacea*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells, magnified.
  - d.* sporangium, magnified.
2. *Bryum roseum*.
  - a.* plant, nat. size.

- b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of outer peristome, magnified.
  - e.* portion of inner peristome, magnified.
- 3. *Leptobryum pyriforme.*
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
- 4. *Orthodontium gracile.*
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of outer peristome, magnified.
- 5. *Aulacomnion palustre.*
  - a.* female plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells, magnified.
  - d.* sporangium, magnified.
  - e.* gemmiferous plant, nat. size.
  - f.* gemmæ, magnified.
  - g.* gemmæ, more magnified.
- 6. *Polytrichum septentrionale.*
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
- 7. *P. juniperinum.*
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* peristome, magnified.
  - e.* portion highly magnified.

## PLATE XIX.

1. *Pogonatum nanum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* section of leaves, magnified.
  - d.* section of one of the lamellæ, magnified.
  - e.* young veil, magnified.
  - f.* sporangium, magnified.
2. *P. aloides*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* young veil, magnified.
  - d.* sporangium, magnified.
3. *P. hercynicum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *Atrichum undulatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium, without lid.
5. *Diphyscium foliosum*.
  - a.* plants, nat. size.
  - b.* plants, magnified.
  - c.* sporangium, magnified.
  - d.* veil, magnified
  - e.* peristome, magnified.
  - f.* leaf, magnified, with two perichaetial leaves.
6. *Buxbaumia aphylla*.
  - a.* plants, nat. size.
  - b.* sporangium, magnified.
  - c.* veil, magnified.

- d.* peristome, magnified.
  - e.* a portion of inner peristome, magnified.
7. *Tetrodontium Brownianum*.
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* perichaetial leaves, magnified.
  - e.* sporangium, magnified.
  - f.* peristome, magnified.
8. *Tetraphis pellucida*.
- a.* plant, nat. size.
  - b.* gemmiferous plant, nat. size.
  - c.* leaf, magnified.
  - d.* gemmiferous apex, magnified.
  - e.* young veil, magnified.
  - f.* sporangium with lid, magnified.
  - g.* sporangium without lid.
  - h.* peristome, magnified (the transverse lines are too strongly marked).

## PLATE XX.

1. *Zygodon conoideus*.
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
2. *Z. viridissimus*.
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium, after lid has fallen.
3. *Z. lapponicus*.
- a.* plant, nat. size.

- b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* sporangium, after lid has fallen.
4. *Orthotrichum cupulatum.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome magnified.
5. *O. anomalum.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium, without lid.
6. *O. diaphanum.*
- a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
7. *O. pulchellum.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* young veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium without lid, magnified.
8. *O. leiocarpum.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.

## PLATE XXI.

1. *Ptychomitrium polyphyllum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *Glyphomitrium Daviesii*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified (generally plicate).
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
3. *Racomitrium aciculare*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* tip of tooth, more highly magnified.
4. *R. heterostichum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
5. *Grimmia pulvinata*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, with ring, magnified.
6. *Schistidium apocarpum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* columella, with lid attached, magnified.



7. *Hedwigidium imberbe*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
8. *Hedwigia ciliata*:
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* tip of leaves, magnified.
  - d.* sporangium, magnified.

## PLATE XXII.

1. *Encalypta vulgaris*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* tip of axis, with archegonia, paraphyses, and vaginula, magnified.
2. *Cinclidotus fontinaloides*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome and tip of columella, round which the tips of some of the teeth are wound, magnified.
3. *Tortula muralis*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium and veil, magnified.
  - d.* sporangium with lid, magnified.
4. *T. ruralis*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.

- c.* sporangium, magnified.
  - d.* peristome, magnified.
  - e.* part of peristome, more highly magnified.
- 5. *Leptotrichum homomallum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
- 6. *Didymodon flexifolium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
- 7. *Distichium capillaceum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
  - e.* ring, magnified.
- 8. *Desmatodon nervosus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium without lid, magnified.
  - e.* portion of peristome, magnified.

## PLATE XXIII.

- 1. *Anacalypta lanceolata*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium without lid, magnified.
  - e.* portion of peristome, magnified.

2. *Pottia crinita*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* young veil, magnified.
  - d.* sporangium, magnified.
  - e.* follicle of *P. cavifolia*.
3. *Pottia Heimii*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *Campylopus flexuosus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* part of peristome, margined.
5. *Ceratodon purpureus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
  - e.* tip of tooth, more highly magnified.
6. *Leucobryum glaucum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* tip of leaf, magnified.
  - d.* sporangium, magnified.
  - e.* part of peristome, magnified.
7. *Dicranum scoparium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* part of peristome, magnified.
8. *Dicranella heteromalla*.
  - a.* plant, nat. size.

- b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
9. *Cynodontium Bruntoni*.
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
10. *Arctoa fulvella*.
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.

## PLATE XXIV.

1. *Blindia acuta*.
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* tip of leaf, magnified.
  - d.* sporangium, magnified.
  - e.* sporangium without lid.
  - f.* part of peristome, magnified.
2. *Seligeria calcarea*.
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified (broader and more acute than usual).
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
3. *Brachyodon trichodes*.
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* veil, magnified.

- e.* sporangium, magnified.
  - f.* lid, magnified.
  - g.* part of peristome, with ring, seen from within, magnified.
4. *Campylostelium saxicola.*
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* part of peristome, with ring, magnified.
5. *Rhabdoweissia denticulata.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
6. *Weissia controversa.*
- a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* part of peristome, magnified.
7. *Hymenostomum squarrosum.*
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* sporangium, magnified.
  - e.* mouth of sporangium, magnified.
8. *Phascum bryoides.*
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* sporangium, magnified.
9. *Physcomitrella patens.*
- a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* sporangium, magnified.

10. *Archidium phascoides*.*a.* plant, nat. size.*b.* plant, magnified.*c.* leaf, magnified.*d.* sporangium, magnified.

## ADDENDA.

p. 70. Under *Neckera pumila*, insert—

**N. Philippeana**, *Br. & Schimp.* has been found in Scotland, but it is only a state of *N. pumila*.

p. 104. Before *H. molle*, insert—

43\*. **H. eugyrium**, *Schimp.*; tufted; stems short, much branched; leaves crowded, thin, elongated, flexuoso-falcate, deflexed, nerveless, serrulate at the tip only; sporangium shorter; ring very broad.

On wet rocks, Bangor, *W. Wilson*. Bearing fruit in summer.

This is *Hypnum palustre*, var., *Br. Brit.*

p. 108. After *Hypnum cordifolium*, insert—

49\*. **H. giganteum**, *Schimp.*; dioicous; stem elongated, stout, pinnate or subbipinnate, ramulose, slightly radiolose; stem-leaves large, more solid, very concave, spreading, broadly cordato-ovate; nerve reaching nearly to the tip; angles decurrent; branch-leaves elongated; terminal twisted, subulate; sporangium horizontal; oblongo-cylindrical, ringless; lid mammillary.

In bogs, Cheshire, *W. Wilson*. Bearing fruit in early summer.

A magnificent species, at once distinguished from *H. cordifolium* by its inflorescence.

p. 117. Under *Hypnum aduncum*, insert—

*Hypnum aduncum*, var. *tenue*, *Bryol. Eur.*, is *H. vernicosum*, *Lindberg*, and *H. pellucidum*, *Wils. MSS.*, and has been found at Wybunbury bog by *Mr. Wilson*.

p. 145. After *Myurella julacea*, insert—

2. **M. apiculata**, *Schimp.*; stem soft, brittle; leaves loosely imbricated or spreading, opaque, suddenly apiculate; tip recurved; teeth of peristome small, pale.

On rocks amongst the Breadalbane mountains, *Mr. Gardner*. Bearing fruit on the Continent in summer.

Bright glaucous-green.

p. 169. Before *Bartramia ithyphylla*, insert—

1\*. **Bartramia stricta**, *Brid.*; tufted; leaves erecto-patent, lanceolato-subulate; nerve excurrent; sporangium erect, symmetrical; peristome single.

On the ground, Sussex, *Mr. Milten*. Bearing fruit in early summer.

The simple peristome and aristate nerve, in addition to the erect sporangium, readily distinguish this from *B. ithyphylla*.

*Mr. Wilson* believes that he has found *B. marchica* in Shaoklin China.

p. 194. Under *Bryum erythrocarpum*—

Mr. Wilson considers var.  $\gamma$ . **murorum**, *Schimp.*, which is peculiar to mortared walls, and occurs at Bristol, and not unfrequently in North Wales, as a distinct species, under the name of *B. murale*, Wils.

p. 197. Under *Bryum pseudotriquetrum*, insert—

var.  $\delta$ . **cavifolium**, *Schimp.* (*Bryum neodamense*, *Itzigsohn*), has been found near Southport by Mr. Wilson.

p. 198. After *Bryum pallens*, insert—

23\*. **B. Duvalii**, *Voit*; tufted, very soft, bright purple; stems tall; leaves distant, spreading, very decurrent, broadly ovato-lanceolate, quite entire; nerve vanishing below the tip; sporangium equal, constricted below the mouth when dry.

In bogs. Found by Mr. Wilson, but I do not know the exact locality.

p. 254. Under *T. oblongifolia*, insert—

*Tortula oblongifolia* has lately been found in Sussex. I am mistaken in saying it is not taken up by Schimper. A description will be found compiled from the 'Bryologia Britannica,' at p. 185 of the Synopsis. It is doubtful whether it really differs from *T. Vahliana*.

p. 286. Under *Arctoa fulvella*, insert—

(Plate 23, fig. 10.)



# HANDBOOK

OF

## BRITISH MOSSES.

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### Introductory Matter.

#### CHAPTER I.

##### PRELIMINARY OBSERVATIONS.

FEW words are taken with greater latitude in general acceptance than the word Moss. The botanist assigns to it a definite meaning, confining it to a peculiar division of plants, such members of which as are distributed through the British Isles it is proposed to illustrate in this volume. As used popularly, not only are Lichens and Liverworts included in the term, or even some of the more shrubby seaweeds, as for example Iceland Moss, almost the whole tribe of *Jungermannia*, and the Corsican Moss of our shops; but many Phænogams of a low tufted growth, such as some of the shorter Stonecrops, and other plants of a like habit, as, for example, *Sedum acre*, which is the Golden Moss of every cottager. Nor are the Greek or Latin words *βρύον* and *muscus* used by ancient authors with more discrimination, not only Algæ, Lichens, and true Mosses being included, but even some more perfect plants. The doubt perhaps is whether Mosses were ever in-

cluded in the word *βρύον*, though there is probability in its favour; and therefore, while the term *Muscologia* has been objected to as a barbarous word, consisting partly of Latin and partly of Greek, *Bryologia* has scarcely fared better, though it appears unobjectionable except in the eyes of hypercriticism.

The true Mosses, however, when accurately examined, are very distinctly separated by habit and character from other vegetable productions which are confounded with them,—approaching indeed nearer to the Liverworts than other plants, though distinguished even on a superficial view from the more conspicuous of these, as the cup-bearing *Marchantia*, which is so common on our shady walks in the garden, or which, to the gardener's annoyance, so often runs over the soil of his flowerpots,—by the absence of everything like a scaly habit, and the definite leafy axis; while they are separated from the leafy species of *Jungermannia*, not only by their urn-shaped and almost universally entire sporangia, but by the very different character of the foliage, for the leaves very rarely assume anything approaching the eccentric outline which is common in the more moss-like Liverworts; while if we descend to minuter points, there is the absence of all admixture amongst the spores of spiral threads, even in the few individuals which have a sporangium split into four or more equal lobes, after the manner of *Jungermannia*. Another less obvious character consists in the different nature of the cellular product of the germinating spores, which in Mosses consists of more or less branched threads, with the single exception of the genus *Sphagnum*, in which it is scaly, and resembles the type which prevails in the Liverworts (Plate 1, fig. 1).

As regards general appearance, Mosses form either patches consisting of numerous distinct individuals, or variously-sized tufts, with simple or branched stems varying from less than a

line to many inches in length, mostly of a clear unsullied green, but sometimes, especially when exposed to the sun, variously shaded with golden brown or different tints of red and purple, in a few cases only being almost devoid of colour, or of a very pale glaucous green. The stems are either erect or more or less inclined, sometimes indeed quite prostrate and closely attached to the soil or substance on which they grow. They are clothed with leaves, or in those cases where, at first sight, they seem absent, as in *Buxbaumia aphylla* (Plate 19, fig. 6), with rudiments of leaves, which are for the most part symmetrical, and arranged round the axis in definite order, so as to present a more or less cylindrical appearance, or, in a few cases, so disposed as to make the stem or branches of the plants flattened or triangular. These leaves are usually without true stipules or the inflected lobes or sacs which are so common in *Jungermannia*, though in one or two genera, as *Hypopterygium* (Berk. Crypt. Bot. fig. 99 *d*), there are either true stipules, or certain of the leaves assume the form of stipules, while in some *Homalia* there is an approach to inflected lobes. The habit of Mosses is indeed so peculiar, that when their distinguishing features have been once mastered there is seldom the slightest difficulty in distinguishing them at the first glance, and determining whether a Moss or Liverwort is before us. In those cases where the stem is much flattened, and indeed in all doubtful cases, every difficulty is removed if a single fruit is present, except in the small osculant group of *Andreæ*, which in their sporangium and colouring approach nearer to *Jungermannia*.

Mosses are naturally divisible, according to their external characters, into two great classes, which have received the names of *Acrocarpous* and *Pleurocarpous*, because in the one case, the fruit terminates the stem, and in the latter, it is

apparently lateral, though in reality seated at the extremity of a greatly reduced branch. In most cases this distinction is at once evident from the habit, even where fruit is not present.

In a few genera, however, as *Fissidens*, we have the fruit-bearing branches more distinct. But these are considered by many as belonging to a separate division (*Cladocarpi*), since the branch is more developed than in *Pleurocarpi*, though still very short. This division is not however adopted here.\*

A third division (*Syncladei*) comprises the *Sphagna*, in which the branches are produced in fascicles, and these have several other peculiarities, insomuch that some authors exclude them from Mosses altogether, while a fourth (*Schistocarpi*) includes the genera in which the sporangium is cleft longitudinally into four or more lobes of greater or less length.

\* In the Tasmanian *Bartramia pusilla*, Wils., there is an approach to Cladocarpous Inflorescence.

## CHAPTER II.

## NATURE OF MOSSES.

MOSSES are for the most part aerial vegetables, attached by rootlets to the soil or substance on which they grow, and deriving their nutriment partly from this matrix, but partly also from the moisture of the surrounding air, or, in aquatic species, from the water in which they are immersed. In dry weather they are often completely dormant, and assume a peculiar contracted, shrivelled appearance, as if they were dead, and very different from their condition in active growth. The first shower however revives them, and the functions of all their parts are as vigorous as ever.

Some species are strictly aquatic, though very rarely bearing fruit when completely immersed. In several cases the base alone is constantly moist, but the upper part of the plant, though exposed to a burning sun, is kept moist by capillarity. If however such species are accidentally dried up, they revive when the soil is again saturated with moisture. Others flourish only when exposed pretty constantly to the spray of waterfalls, or when entirely shaded from the sun, in caves, or under the shelter of rocks or in their crevices. Some, as species of the exotic genus *Meteorium*, hang down in loose locks from the branches of trees, giving the woods a dismal

appearance, like that produced by *Alectoria jubata* or the prevalence of Usneoid Lichens, or the pendulous downy *Tillandsiæ*. A small number of species seem to affect the dung of graminivorous or carnivorous animals, or other animal substances, the species peculiar to the one seldom if ever occurring on the other.

Mosses, like Phænogams, are monœcious, diœcious, or polygamous, and in some rare cases synœcious, and for the most part definitely so, though a few instances occur in which the position of the male and female fructification is not constant. In monœcious or polygamous species the fruit is generally produced abundantly; but in those which are strictly diœcious, especially where the male and female plants form distinct and often distant patches, it is frequently extremely rare, from the difficulty arising to the impregnation of the young female fruit. In such cases multiplication depends entirely upon some subsidiary mode of reproduction, especially where a single sex only, as is often the case, exists in a given district.

Mosses belong to that higher and more important division of Cryptogams which not only makes a near approach to Phænogams in habit, but which differs essentially from the lower Cryptogams, as Fungals and Algæ, in the more complicated nature of the fructification, and the various phases which the whole plant exhibits during the progress of evolution.

In Ferns and their allies the result of germination is the production of a cellular expansion of various forms, whether globose or scale-like or irregular, whether more or less differentiated and distinct from the spore itself or confluent with it externally or internally or both, on which or within the substance of which, at least in the more normal cases, two organs are produced of different sexes, the one of which, called an

‘archegonium,’ consists of a pitcher-shaped cyst, within which there is a single free cell at the base, which is destined, after impregnation, to produce first an embryo and then by continued development a perfect plant like the parent, which either once only or annually through a shorter or longer succession of years gives rise to fruit, consisting of a sporangium filled with spores, destined after germination to go through the same circle of phenomena. In some cases two different kinds of spores are produced, one of which gives rise to the male, the other to the female organs.

In Mosses, on the contrary, and their allies, the object after germination is to form a more or less filamentous or scale-like stratum, resembling either a little green Lichen or one of the verdant thread-like Confervæ, such as *Lyngbya muralis*, which clothes damp trees or the soil at the base of walls on the northern side, or that which is least exposed to the direct rays of the sun, and, when this is perfected, nodules appear, which by cell formation give rise to the proper plant, whether symmetrical or unsymmetrical, whose office is to produce fruit. On this plant then, either in the same or in distinct individuals, male and female organs are produced (Plate I. fig. 2, 3, 4), resembling more or less closely the antheridia and archegonia of Ferns. In the latter there is a cell at the base analogous to that in the archegonia of Ferns, which is destined to be fertilized by spermatozoids formed in the tissue of the antheridia.

The result however of fertilization is totally different from that which obtains in Ferns. There a distinct plant was produced from the fertilized cell, the result of germination being a prothallus, and the result of impregnation the true plant; whereas in Mosses and Moss-allies the cell-division of the basal cell of the archegon is a sporangium, or, as it is fre-

quently called, a capsule or theca, which, with various modifications, gives rise to the spores.

In many cases life ceases in the parent plant after the formation of the sporangia, but in others a new growth is produced, which in time gives rise to a new set of archegons and antheridia, and in some species this is repeated indefinitely.

The whole process, then, from the formation of the spore to the fertilization of the embryonic cell in the Fern, answers to the same process in the Moss up to the fertilization of the rudiment of the sporangium in the archegon, but in the latter case there are two distinct stages, the one extending to the formation of the first cell of the young plant, the other to the fertilization of the cell in the archegon; and it is well to distinguish these as the prothalloid and thalloid stages respectively; while in Ferns the first result of germination may more fitly be called the pro-embryonic stage. It is not right to give the same name to organisms which are by no means strictly analogous in the two cases.

Having made these general remarks on the relations of Mosses and Ferns and their respective allies, I shall proceed in the next chapter to offer a few observations on the several parts, beginning with the germination of the spores,—their primary development in the sporangia being reserved till I speak of the structure of the fruit.



## CHAPTER III.

## ON THE DEVELOPMENT AND STRUCTURE OF MOSSES.

*a.*—THE spores of Mosses, like those of most Fungi and of many other Cryptogams, consist of a grumous mass containing occasionally minute oil-globules enclosed in a double membrane, the inner one of which is hyaline and perfectly even, and lines the outer one, which is more or less coloured and often minutely sculptured.

When the spores are sufficiently moistened, either on their proper matrix or within the folds of compressed leaves, as in *Fissidens*, and the temperature is favourable, the outer membrane swells and ultimately bursts, giving egress to the inner membrane, which soon protrudes and forms a little obtuse tube. This elongates rapidly, and becomes septate and ultimately branched, so as to form, together with the threads proceeding from other spores, a felt-like mass, which is often of a bright green, and in this stage is often mistaken for some species of *Conferva*.

The joints are more or less filled with chlorophyll so long as the threads are in a healthy state. The threads proceeding from a single spore are capable of forming several fertile buds, but whether in many cases more than one of these comes to perfection depends upon the favourable or unfavour-

able circumstances under which they may be placed. Sometimes the primary cell of the spore after the first septum is formed, becomes itself septate, and gives rise to a cellular nodule, and ultimately to a young plant, but more frequently the new plants appear on different parts of the threads, often towards the extremity of the branches or at their tips.

Dr. Hicks, in the twenty-third volume of the 'Transactions of the Linnean Society,' has described wonderful changes which take place in these threads, and their conversion into several genera of Algæ, besides the formation of zoospores; but as he does not identify the species to which the observed threads belonged, and the production of zoospores is a circumstance so extremely anomalous, we find it difficult to believe that he had really portions of some Moss before him, and not the threads of Algæ accidentally intermixed. The reader can, however, refer to his paper and form his own conclusions, if he has no opportunity of testing his observations by actual experiment. Some of Kützing's early papers may, however, previously suggest some necessary caution.

The threads arising from the germination of the spores have received various names, as 'cotyledonoids,' 'protonemata,' 'proembryo,' 'prothallus.' The first of these is objectionable because they have no analogy with true cotyledons, and the third because an intermediate stage must take place before the cell capable of impregnation is produced in the archegon, the result of which, after all, is a sporangium and not an embryo. The production of the plant from the threads is rather gemmiparous than embryonic, and I therefore strongly object to the term 'proembryo,' which inevitably more or less directly leads to confusion. The second name at least is free from error, and if the Moss plant may be called a 'thallus,' the fourth name may be admitted. If new terms were not ob-

jectionable, I should prefer that of 'prophyton,' which simply indicates that it is the forerunner of the true plant.

*b.*—After a time, whatever privileged portion of the threads may give rise to a bud, fibrous rootlets strike downwards from the base, and the bud itself is gradually elongated upwards, according to the character of the plant, into the true axis, clothed with its proper foliage, and in time giving rise to the true fruit, whether male or female, on the same or different plants. These threads are sometimes persistent, as in *Ephemerum serratum* and *Ephemerella recurvifolia*, but in general they vanish almost entirely long before the plant has arrived at maturity.

In *Sphagnum* the course is not precisely the same. The first result of germination, instead of a thread as in the more typical Mosses, is a scale-like expansion (Plate 1, fig. 1) resembling closely the young state of a *Jungermannia*, and producing buds from the notches of the margin.

The prothalloid stage of Mosses must not be confounded with a growth of a very similar appearance, which takes place from the rootlets of some Mosses, as for example, in *Pogonatum aloides* (Plate 19, fig. 2), which is produced after the death of the old plant, and forms a green velvety mass, which at first sight cannot be distinguished from a true prothallus. *Conferva velutina* of authors owes its origin to such a growth, and another supposed *Conferva* is due to a similar development in *Schistostega osmundacea* (Plate 14, fig. 4), the necklace-like ultimate joints of which refract light so strongly that it has been supposed to be phosphorescent.

Rootlets, it has just been observed, are produced at the base of the fertile buds, and this at a very early stage of their development. They are for the most part more slender than the primary threads, more or less distinctly but obliquely ar-

ticulated, branched, and very irregular in outline, though with rare exceptions smooth and even. They are often hyaline at the tips, but below of a more or less decided brown, inclining sometimes to purple, red, tawny, etc., and, as the plant advances in growth, multiply exceedingly (Plate 4, fig. 6). They penetrate more or less deeply into the soil, or crumbling and decayed surface of rocks or bark, and sometimes on calcareous rocks absorb the portion immediately beneath them, so that each part, like the shields of *Lecidea immersa*, is sunk in a little cavity. They are, however, by no means confined to the base of the stem, but frequently, though by no means universally, they clothe almost the whole surface more or less densely, between the intervals of the leaves, often forming, as in *Aulacomnion palustre* (Plate 18, fig. 5), a thick woolly mass. In some cases they are produced also from the base of their leaves, or even from their disk. *Conferva castanea* and *Conferva muscicola*, of English Botany, are undoubtedly developments of this nature. But not only do these roots occasionally give rise to a mass resembling the true primary threads as mentioned above, but amongst certain *Hypna* they produce a little bud, quite different from the parent plant, which gives rise to the sexual organs which were necessary for the reproduction of the species constituting what is called the quasi-monoicous inflorescence. In *Atrichum undulatum* (Plate 19, fig. 4) they form a sort of rope, which frequently generates buds.

The adventitious rootlets not only seem to fix the plant firmly, but they often act as a protection from severe cold, and in many cases either absorb nutriment directly from the matrix like the primary roots, or they imbibe and retain for a time the moisture which is necessary for the support of the plants. In some cases, where the branches are closely packed,

or the plants always more or less immersed in water, as in *Sphagnum*, they are altogether wanting, or present only in an early stage of growth.

c.—The stem is sometimes merely rudimentary, the axis being reduced to a mere point, but it is sometimes much elongated, as in our common *Polytrichum*, and occasionally, as in the exotic *Polytrichum giganteum* and *P. dendroides*, it becomes hard and almost woody, but as far as I have seen, does not present, as has been asserted, concentric lines of growth (Berk. Crypt. Bot. fig. 107). It consists more or less of elongated cells, some of which occasionally show a spiral structure, as in *Dawsonia superba* (Crypt. Bot. fig. 108), and in a few instances faint scalariform markings (Crypt. Bot. fig. 107 c). The walls are generally thin, but occasionally considerably thickened. In *Sphagnum*, the external cells of the stems, like those of the leaves, sometimes, as in *S. cymbifolium*, contain one or more spirals (Plate 2, fig. 1), and in some species, as in *S. molluscum*, the apex projects and is perforated (Plate 2, fig. 3).

The stem may be either perfectly simple or variously branched, erect or decumbent, and in some cases pendulous. It often gives off shoots at the base, which creep along the matrix or are quite subterraneous, and then occasionally confounded with the roots. After a time the tips of these creeping stolons rise above the surface and give rise to new plants.

One mode of branching, by which the plant is renewed from year to year, is known under the name of innovations, and is very common amongst Acrocarpous Mosses, a new growth being produced year after year, just as the old stem is losing its active vitality and has matured its fruit, and frequently immediately beneath the fructification. Two branches are pretty generally produced at the same time, and thus the

branching in each tuft, when torn to pieces, appears dichotomous throughout, each fork representing a year's growth. Thus a tuft of Moss may be entirely dead below, though still fixed by the rootlets, while the circumference is perfectly green and luxuriant. In Pleurocarpous Mosses, on the contrary, true ramification constantly takes place, and the fruit is in fact terminal on a very short branch, whose leaves differ considerably from those of the main stem or branches. In Cladocarpous Mosses the branch (p. 4) is merely a little more developed.

The branches are sometimes irregularly disposed, sometimes decidedly pinnate or bipinnate, and sometimes fasciculate. The stem is occasionally quite unbranched below, as in *Climacium dendroides* (Plate 13, fig. 2) or *Thamnium alopecurum* (Plate 13, fig. 1), and the branches collected above, in which case they are called 'dendroid,' from the resemblance of the whole to little trees.

The stem is in general cylindrical, but it is sometimes flattened or depressed, and in some cases is distinctly triquetrous.

*d.*—The stem and branches are partially or completely clothed with leaves, which are sometimes few and scattered below, though densely crowded above. In some cases, as in *Buxbaumia* (Plate 19, fig. 6) and *Tetradontium* (Plate 19, fig. 7), they are more or less rudimentary, but such exceptions are not of frequent occurrence.

They vary somewhat in structure. Sometimes they consist of a single stratum of cells, which usually contain chlorophyll throughout the whole lamina, but more frequently there is either a thickening at the base, which breaks up at times into two or three nerve-like divergent threads, or there is one central nerve of variable length and thickness, occasionally projecting far beyond the tip of the leaf, and forming a hair-like point.

This nerve often projects beyond the surface of the leaf and especially below, and is sometimes plaited beneath, as in *Dicranum scoparium* (Plate 23, fig. 7), sometimes furnished with close parallel laminæ above, as in *Pogonatum nanum* (Plate 19, fig. 1 *c, d*), and not unfrequently rough or echinulate.

The cells vary greatly in size and form, those at the basal angles being often larger than the rest and less filled with chlorophyll. They also vary greatly in thickness, the walls of two contiguous cells being sometimes so blended together that their distinction is not visible, but occasionally very accurately defined (Plate 18, fig. 5 *c*). The primary cell-wall is not always distinct, but in some genera it is well-defined and sometimes is very irregular in outline.

The edge of the leaf is often serrated or crenulate through the whole or a part only of its course, the serratures consisting for the most part merely of cells projecting beyond their neighbours, so as to give a toothed outline. Sometimes, however, the margin is distinctly thickened, and the serratures or inequalities, if present, may then consist of two or more cells. Indeed, this may be the case where there is no thickening. The cell-walls of the bordering cells are sometimes thicker than those of the rest. A portion of the surface of the leaf, especially towards the edge or tip, like the nerve, is sometimes rough with spine-like projections, arising from the protrusion of individual cells. In some genera the walls of the cells on either surface or on both are strongly granulated, but in such cases the granulations belong to the thickened walls of the cells (Plate 8, fig. 4).

The leaves are generally symmetrical, but this is not always the case, especially where they are equitant, as in *Fissidens* (Plate 14, fig. 2, 3). In some genera, as *Hedwigia* (Plate 21, fig. 8), they are strongly fringed, and in others, as *Sphag-*

*num*, as frequently eroded, though they never assume the eccentric outline which is so common amongst *Jungermanniæ*. An approach however is made in *Homalia trichomanoides* (Plate 4, fig. 5) and in *Schistostega osmundacea* (Plate 14, fig. 4).

In several cases the lamina, beyond the nerve or between the nerve and the margin, consists of more than one stratum of cells, as for example in *Leucobryum glaucum* (Plate 1, fig. 6), where the green cells are imbedded between two strata of white cells, whose walls are perforated, while in *Sphagnum* (Plate 1, fig. 5) the large perforated cells which contain a spiral thread have uniformly a border of narrow distinct green cells.

The border of the leaf is often revolute, and sometimes involute, and the base variously amplexicaul. The whole leaf is sometimes convolute. In every case the leaves are sessile, and they are never deciduous. In some instances, as in *Fontinalis* (Plate 3, fig. 2), they are so closely folded that they are strongly keeled, and eventually split along the keel, so that each leaf looks as if it were double, a circumstance which has occasionally led to error.

Their direction is extremely variable. They are often crowded and imbricated, frequently however they are patent, not unfrequently secund, while many instances occur in which, either wholly or in part, they are remarkably squarrose. In the species with flattened branches they are for the most part really or apparently distichous. In a dry state their direction is often different and sometimes distinctly spiral, while their surface becomes crisped, folded, or undulate.

They are always arranged round the axis in some definite order. Sometimes they are two-ranked with the stem still cylindrical or flattened, sometimes three-ranked, but more



frequently they are arranged in spirals of five or eight, and in some cases the disposition is still more complicated. In a very few instances they are unequal in size, or accompanied by stipules.

Though, however, the stems are almost universally destitute of true stipules, their place is supplied in several *Hypnei* by multitudes of irregular appendages (*paraphylla*) scattered without order over the surface. These are sometimes foliaceous, though often very delicate and jagged, but occasionally they are so repeatedly dichotomous or irregularly divided, that they approach in appearance to radicles, though evidently from their nature and development more nearly related to leaves. They answer in all probability the same physiological purposes as the rootlets, protecting the stem from burning heat, and helping to retain moisture for its sustenance. The genus *Thuidium* (Plate 8, fig. 4) affords excellent examples.

In point of colour, the leaves vary from bright or glaucous green to various shades of brown red or purple. In some species, from defect of chlorophyll, the leaves are nearly white, an appearance which is sometimes due to the cells, like the superficial cells of the aerial roots of Orchids, at length containing air rather than moisture, in which case a slight green tinge is communicated from adjoining or imbedded more minute and slender cells containing chlorophyll. In most instances they revive perfectly on the application of water, though apparently quite dry and parched, and crumbling beneath the fingers; but this is not always so strikingly the case where they are very membranous. Stomates do not occur, I believe, upon the leaves, though they are not uncommon on the surface of the sporangia, in which case they resemble very closely those of Phænogams. In one or two Mosses, as *Pottia cavifolia* (Plate 23, fig. 1 e), there is a little bag on the upper surface

of the nerve, which ultimately splits longitudinally. The contents of this are probably reproductive, and I shall have to speak of other appendages of the nerve when I come to the consideration of the different modes of multiplication other than from the true fruit.

I have now described the vegetative part of the plant, and proceed to state what is known of the fruit, which is of two kinds, male or female.

*e.*—Now, as regards the male organs, whether collected in flower-like disks (*perigonia*), as in *Polytrichum*, in little buds, as *Hypnum* (Plate 6, fig. 3), in heads with the tips of the leaves reflected, as in *Splachnum* (Plate 15, fig. 4), in disks bordered with large leaves, as in *Mnium* (Plate 17, fig. 2), or in catkin-like appendages, as in *Sphagnum*, or associated more immediately with the female organs,—whether mixed with them as in *Bryum*, or placed beneath them as in *Webera*,—the structure is essentially the same. The antheridium consists of an oblong sac, sessile or substipitate, filled with cellular tissue, each ultimate cell of which at length gives birth to a spermatozoid with a straight or curved thread-like body, surmounted by two long, extremely delicate, flagelliform, motile threads, by means of which it can move about rapidly in fluid. The antheridia are usually accompanied by thread-like paraphyses, always more or less distinctly articulated (Plate 1, fig. 3). In *Sphagnum* the antheridia are axillary, and resemble in their delicate stem and globose form those of *Jungermannia*. In some cases they are developed in especial buds springing from the radicular fibres. Their number varies extremely; while in some Mosses they are indefinite, in others they seldom exceed some fixed number.

The paraphyses which separate the antheridia from each other, and which, like the other parts of fructification, present

a strange analogy to similar organs in *Balanophoræ*, vary somewhat in form. The resemblance however is more apparent than real, and is confined to certain species of *Balanophoræ* without extending to the whole group. In *Bryum* they are simply filiform; in *Mnium* the upper cells are much larger, and so contracted at the commissures as to constitute a moniliform thread; in *Polytrichum* they are spathulate and divided above, both transversely and vertically, by numerous cells. In *Diphyscium* they present a curious object under the microscope, the outer membrane of each constituent cell bursting in the midst, so that each commissure has a little cylindrical sheath attached to it, contracted in the middle, and open both above and below.

*f.*—The female organs are far more complicated in their structure, and are disposed in little special offsets from the stem, or at its tip. Two parts have been distinguished in the floral bud, if it may be so called, the ‘perigynium,’ which consists of leaves encircling the true bud, and the ‘perigamium,’ the portion which contains the fruit; but these distinctions are of little consequence. I shall have occasion to speak of what is called the ‘perichæcium’ afterwards.

In an early stage of growth, the female fruit, or ‘archegon,’ consists first of a single cell, then of an oblong cellular mass, closed above and without any central cavity. As, however, cell-division proceeds, the cells recede from the centre, and leave a linear channel, at the base of which, in a slight dilatation, is seated a single cell fixed below and free above, which ultimately gives rise to the sporangium. The archegon, when fully formed, is flask-shaped and perfectly free above, with a long neck and an evidently cellular structure, the central channel being visible through the walls (Plate 1, fig. 2). The cells at the top of the archegon become loose and detached

from each other, so that some of them fall off, and an aperture is left for the admission of the spermatozoids, which in moist weather soon find their way to the aperture, and travel down the channel to the basal cell, when ready for impregnation.

After impregnation has taken place, cell division commences in this cell, and is continued till an oblong or subglobose cellular mass is formed within the archegon, and distinct from it, stretching its walls, and in most cases lifted upwards by the elongation of a distinct stalk, till the archegon splits at the base, or more rarely in the centre forming above a little hood or veil to the body called a 'calyptra,' or veil, and after dehiscence, leaving behind a little sheath, called the 'vaginula,' from the centre of which the fruitstalk grows, and which is in fact the foundation or extreme base of the archegon and confluent with the axis, as in the course of development, should the archegon have been at first lateral, it becomes terminal.

According to the mode of dehiscence, the vaginula is more or less modified, and in many cases it is so incorporated with the axis, that the axis itself seems hollowed out, and the external surface of the vaginula is rough with abortive archegons and paraphyses. In general only a single archegon in each group proceeds to perfection, though doubtless several may be impregnated, exactly as in a bunch of pear blossoms, though several may be impregnated and the ovules swell for a time, some one or more individuals will take the lead, abstracting the nourishment from the rest, so that their progress is arrested, and they ultimately become detached at the base of the peduncle. In some cases, as in *Bryum roseum*, several archegons are perfected. In *Sphagnum* the vaginula is lifted up on a cylindrical hyaline stalk, the sporangium itself being almost sessile, and the same structure obtains in *Andreaea*.

The veil itself is more or less persistent, sometimes falling

off at an early stage of growth, as in *Mnium*, but sometimes crowning the sporangium till it arrives at maturity, as in many *Hypna*. If it remains entire at the base, or is only split into several more or less symmetrical lobes, it is called mitriform; but if the fissure is confined to one side only, it is termed cucullate (hood-shaped) or dimidiate. The base is sometimes fringed, as in *Daltonia splachnoides* (Plate 3, fig. 4), and sometimes has little membranous appendages, as in several *Encalyptæ*. These are at first inflected, being derived from the surface of a conical appendage to the vaginula within the veil, which ultimately forms an ocrea to it (Plate 22, fig. 1).

The surface is sometimes even, sometimes granulated, scaly, or spiny, and sometimes grooved or costate. It is either quite naked or clothed with filaments, which are sometimes erect, sometimes dependent. In *Polytrichum* and *Pogonatum* they form a striking character, and are so much developed that they entirely conceal the minute veil. The top of the veil is for the most part oblique, and is thicker than the base, and sometimes granulated when the rest of the surface is even. This in a young state was formerly regarded as a real stigma, but it is rather analogous to the elongated fimbriated coat of the ovule in *Gnetum*, impregnation being effected by immediate contact of the spermatozoids with the embryonic cell, if so it may be called, where the result of impregnation is a sporangium and not a plant.

Occasionally the veil swells towards the base long before the sporangium is large enough to force it out, as in *Funaria* (Plate 16, fig. 6) and *Physcomitrium*, in which cases it has a peculiar vesicular appearance.

The fruitstalk is sometimes curved at the base, within the vaginula, as occasionally in *Encalypta* and *Campylopus*. It is often quite even, but not unfrequently the surface is distinctly

granulated. It is often perfectly straight above, but frequently decidedly curved, altering occasionally its direction as the sporangium swells. It is frequently twisted either to the right or left, and either enters abruptly into the sporangium, or gradually passes into it, forming with it or beneath it a little swelling or apophysis.

Even in such cases as *Splachnum luteum* (Crypt. Bot. fig. 106 *d*), where the apophysis at length acquires such an enormous size and appears quite distinct, if we examine the stem and sporangium in an early stage of growth, we shall find that the apophysis belongs quite as much to the stem as the sporangium, though the external cells in some instances are rather those of the sporangium. In *Sphagnum*, the fruitstalk is reduced to a little bulb.

The base of the fruitstalk, especially in Pleurocarpous Mosses, and sometimes the whole fruit, is immersed in leaves very different from the rest, even from those of the perigynium, which together are called the perichæcium. They are perfected at a later period than those of the perigynium, and require to be distinguished, because occasionally they afford good specific characters.

The sporangium in most Mosses, when ready to develop the spores, consists of a central columella continued to the apex, a surrounding spore-sac, the inner membrane of which adheres to the columella, or is separated from it by threads as in *Polytrichum*, and the external wall, which may either be confluent with the outer wall of the spore-sac, as in *Sphagnum*, or free or connected by threads (Plate 1, fig. 7, 8). In *Archidium* there is ultimately no columella, and in *Sphagnum* the spore-sac, instead of forming a little cylinder round the columella, consists of a hemispherical, or more correctly a meniscoid, cyst at the top.

The walls of the spore-sac are generally even, but in *Polytrichum* and some neighbouring genera they are strongly puckered. The spore-sac is at first filled with a nearly uniform cellular mass. The component cells are at length differentiated, some remaining abortive, and others, by crucial cell-division, producing the spores within the cavity. In a few cases spores have been generated within the tissue of the columella, but this is quite exceptional. In general they separate from each other, when mature retaining occasionally, as in *Archidium*, something of the angular form, produced by mutual pressure (Crypt. Bot. fig. 102), but sometimes they are perfectly globose. In an exotic Moss, *Eucamptodon perichæticalis*, the cell-division is continued further, and the eight resultant spores are permanently retained in the mother-cell, so far as observations have hitherto been carried (Crypt. Bot. fig. 99 e). In *Splachnum* they radiate regularly from the columella.

When the columella has performed its functions, which consist probably in supplying nutriment to the spore-sac, it dries up, and sometimes remains attached to the tissue at the apex, with which it is either continuous, or, as in *Polytrichum* and *Sphagnum*, perfectly distinct. In *Polytrichum* it forms a dilated membrane, closing up the spore-sac above and preventing the too hasty dispersion of the spores.

The top of the sporangium or lid, except in a very few genera, where it remains permanently attached, and the spores escape only by the decay or irregular rupture of the walls, separates from the rest, just in a line with the top of the spore-sac, by a regular horizontal fissure, the fissure being either quite uniform or furnished with a rigid or elastic ring, consisting of a variable number of cells, sometimes only a single row, which either separate immediately on the bursting of the lid, or remain permanently attached. One of the best examples is afforded

by *Funaria hygrometrica*, in which it is rather complicated, and springs off the moment the lid bursts, each portion twisting up spirally from within outwards. The lid itself varies in form, and is either extremely short and convex, with or without a central apiculus, or more or less elongated, being sometimes as long as or longer than the capsule. In most cases it falls off entirely, but sometimes it is suspended at the top of the dry columella, as in some *Splachneæ*. Sometimes when falling it carries with it a part or the whole of the columella, as in *Pottia* and *Schistidium* (Plate 21, fig. 6 e).

The mouth of the sporangium thus exposed by the rupture of the lid, and without taking the annulus into account, is either entirely naked, closed more or less perfectly with a narrow membrane spreading over the spore-sac, or furnished with one or two rows of more or less convergent teeth, separate or connected at the base, sometimes indeed so intimately connected as to form a plicate membrane variously modified, according as the upper portion of the constituent teeth is more or less free. The teeth are either four in number, or constitute some multiple of four, in the less numerous cases being frequently divided by lines in accordance with the general rule. Sometimes though free at the base, they are connected by transverse bars above, so as to constitute a network, as in *Fontinalis* (Plate 3, fig. 2); and sometimes the very tips of the teeth are connected so as to form a little membrane, as in *Funaria* (Plate 16, fig. 6).

The teeth vary slightly in their origin, being occasionally more or less confounded with the annulus, or anomalous as to their formation, as in *Polytrichum*, *Buxbaumia*, and *Tetraphis*, but as a general rule, each individual of the outer row of teeth, or, as it is called, the outer peristome, arises partly from the thickening of the walls, especially towards their centre, of



the vertical row of cells (Plate 1, fig. 8 *h*), which is continued within the lid from the corresponding row (*k*) in the outer wall of the space intermediate between the wall of the sporangium and the spore-sac, and partly of the contiguous walls of the cells (*g*) which spring immediately from the apex of the intermediate space (*i*). The inner peristome is formed from the thickening of the opposite sides, more towards the interior of these last cells (*g*) and the contiguous cell-walls (*l*), which are continued from the cells of the inner wall of the intermediate space (*m*). In other words, if we suppose the outer and inner walls of the intermediate space, consisting each of a single layer of cells, to be continued above, but connected beyond its apex by a single layer of cells (*g*),—the outer wall of the cells uniting the two walls continued upwards of the intermediate space, together with the inner wall of the contiguous cells (*h*), will, when thickened, give rise to the outer peristome; while the inner wall of the uniting cells (*g*) and the outer wall of the cells continued from the inner wall of the intermediate space will yield the inner peristome.

In some cases, where the whole wall is not thickened, but two or three thickenings take place in the same cell-wall, with intermediate free spaces, the number of teeth is deranged as in *Tortula*, but if two are formed, the fringe will still be symmetrical (Crypt. Bot. fig. 98 *a*). Sometimes the inner teeth arise at the angles of four contiguous cells, and if so, they will generally alternate with the teeth of the outer peristome.

Sometimes, as in *Tetraphis* (Plate 19, fig. 8), the tissue within the lid splits up into four solid masses, which form the teeth, while in *Polytrichum*, the teeth, which are continuous with the membrane which closes up the ripe spore-sae, consist of several layers, which in the Antaretic *Dawsonia*, where there is no diaphragm, become distinct from each other and

form a short tuft of cottony threads. In *Buxbaumiei* the outer peristome appears to be derived from the outer strata of the walls of the sporangia, and not from the wall of the intermediate space, and traces of the same structure may be found in other Mosses, as *Orthotrichum cupulatum* (Plate 20, fig. 4).

In the more normal peristomes, the teeth vary in form, length, sculpture, direction, connection, and many other points which it is needless to enumerate here, as they are indicated under each genus. These teeth, it may be observed, have not the slightest homology with the leaves, and therefore none with the petals of flowering-plants, being derived in a totally different way. They are not in fact modifications of leaves, but arise from the mere thickening of the walls of two contiguous strata of cells. They are not like the leaves, arranged spirally round the axis, but their bases are all in the same plane, and their symmetrical number is grounded on the same law which is so common amongst *Cryptogams*, even where organisms are derived from the contents of cells, as for example, in the asci of Fungi and Lichens. Supposing the observation were correct, which describes the tip of the columella as occasionally producing leaves, this would be no confirmation of the doctrine that the teeth of the peristome are of similar origin, as they would be derived in a manner altogether different in the two cases.

## CHAPTER IV.

PROPAGATION OF MOSSES INDEPENDENT OF THE  
FRUCTIFICATION.

IN all plants, besides the normal mode of fructification, there are subsidiary modes of multiplying individuals, in contradistinction to species, and these are peculiarly abundant in Cryptogams. Without some provision of this kind, many diœcious Mosses, in which the plants of the two sexes rarely if ever occur in the same tuft, would of necessity die out. Provision has however been made in various ways to supply the defect, or to be accessory to the more normal rule.

The true rootlets, together with those which are produced so abundantly on the stem, or occasionally on other parts, are themselves not unfrequently a means of multiplication. Without adverting particularly to those cases in which they develop plants of a different sex from the parent, the lower roots especially as in some *Phasca* and *Polytricha*, send up to the surface green threads, which can scarcely be distinguished from those which are due to the germination of the spores, and which, like them, generate buds, which in due time give rise to perfect plants. *Conferva velutina* (Eng. Bot. t. 1556) is a well-known example.

Threads are also produced from the surface of the leaves,

which propagate the plant, as in various *Orthotricha*. *Conferva muscicola* (Eng. Bot. t. 1638) is a case in point. These differ in degree of development. Sometimes they are green and cylindrical or clavate; sometimes they are scarcely distinguishable from rootlets. In *Andreaea*, the filaments assume a different type, and from the quadrifarious division of their endochrome, so closely resemble some of the Palmelloid Algæ, that it is not easy to draw the line between them.

In other cases propagating granules are produced on the midrib, as in *Pottia cavifolia* (Plate 23, fig. 2 *e*), or articulated clavate processes at the tip of the midrib, where it terminates below the apex, as in the exotic *Calymperes Afzelii* (Crypt. Bot. fig. 100 *b*), or at the very tip, as in *Calymperes rigida*. Similar bodies to these last are produced on distinct peduncles, as in *Aulacomnion palustre* and *A. androgynum* (Plate 18, fig. 5 *g*), where there are sometimes vertical as well as transverse partitions, or in little rosettes, as in *Tetraphis pellucida* (Plate 19, fig. 8 *b, d*).

Sometimes, again, buds are produced in the axils of the leaves, as in many Pleurocarpous Mosses. Even the leaves themselves occasionally throw out rootlets below, and may thus serve for propagation when broken off (Plate 8, fig. 5 *b*), while those of *Leucobryum glaucum* often produce new plants at their tips.

The growth of Mosses from year to year by means of innovations, may also be referred to the same category, or at least is closely analogous. But many annual, or at least apparently annual, species are propagated on the same spot year after year, not by innovations, but by radicular tubercles.

## CHAPTER V.

## VARIATIONS OF MOSSES.

SEXUALITY seems to be a necessary cause of variations. So long as plants are propagated by buds, or stolons, or gems, or by any other adventitious organ, there is some security for the produce being similar to the parent, though modifications even in these cases may be induced by varied climatic conditions, or other circumstances which may exercise a certain influence on the new plant. When we consider what wonderful modifications are effected in the evolution of the embryo in the animal world by mere change of position or a partial privation of atmospheric air during the development of the ovum, we may well be prepared for many curious phenomena amongst vegetables, whose germs may be placed under anomalous conditions. And if it is true that variations will take place when increase is due only to adventitious organs, what an immense source of change exists in growth by impregnation, where through countless ages cross-impregnation has taken place, spreading far and wide the peculiarities of individuals, in some modified form, if not in all their intensity, amongst succeeding generations.

If the limits of species are often doubtful among Phænogams, they are no less so amongst Cryptogams; and Mosses

form no exception to the rule. Races, species, subspecies, and varieties alike scarcely admit of accurate definition, and have different meanings according to the point of view from which they are regarded. While some Mosses admit at once of accurate separation from all others, without any intervening links, there are natural groups, especially amongst *Hypnei*, which admit of subdivision into others possessed of more or less predominant characters, but where it is almost impossible to say what is or is not a species. Take for example the common *Hypnum cupressiforme*, and you will find some of its acknowledged varieties more palpably different from each other than some of the neighbouring species which are admitted as distinct. Indeed this species may be pointed as exhibiting the greater part of the changes to which Mosses are subject. Besides difference of size, the stem with the leaves varies from compressed to nearly cylindrical, and in its mode of branching and length; the leaves differ in size, form, and direction, in the presence or total suppression of the nerve, and in the condition of the margin; the sporangium, in its inclination, length, and form, and the lid, in the degree of its development. All these, and other differences, occur in a single species. But differences occur also amongst Mosses in the areolation of the leaves, the length and curvature of the fruitstalk, the size of the apophysis,—whether belonging to the peduncle or sporangium,—the nature of the inflorescence, and, what is of the utmost importance as regards generic distinctions in the condition of the peristome, which in the same species, as in *Encalypta vulgaris* (Plate 22, fig. 1), may be present or entirely wanting; or, as in *Orthotrichum anomalum* (Plate 20, fig. 5), there may be rudiments of an inner peristome, while in other cases there may be none. Great differences may also exist in the condition of the outer teeth, whether as regards their

more or less imperfect development, or the nature of their division, as in the *Dicranei*.

From all these causes, the distinction of species requires great caution ; and, after all that has been done towards reduction, it is still quite certain that much still remains to be accomplished, and that many supposed species owe their distinctions merely to changes which arise from climatic conditions or differences of habitat.

## CHAPTER VI.

## HABITATS OF MOSSES.

IN speaking of the nature of Mosses (p. 5) we have already mentioned the sorts of situations and conditions under which they occur. While many are almost indifferent to their place of growth, whether on rocks or branches of trees, or on the ground, others are confined to a peculiar matrix, as those *Splachna* which require for their nutriment either the dung of an herbivorous or carnivorous animal, or the Mosses which affect some especial kind of rock—whether siliceous, as *Andreææ*, or calcareous, as *Seligeria calcarea* (Plate 24, fig. 2) or *Encalypta streptocarpa*—for their nutriment or growth. Sandstone caves seem the peculiar requisite of *Schistostega*. A few Mosses seem to flourish peculiarly upon straw roofs, as *Tortula ruralis* (Plate 22, fig. 4), but they are by no means confined to such a situation. The decaying thatch merely supplies a richer nourishment than usual, exactly as it does to *Agaricus furfuraceus* and *A. stipitarius*, which are finer in such situations than elsewhere.

Elevation however has no less influence on the occurrence of various species. While some are almost ubiquitous, we should in vain seek for *Conostomum boreale* (Plate 15, fig. 8), *Polytrichum sexangulare*, or *Pogonatum alpinum*, at low alti-



tudes, except in high latitudes. Other things being equal, the zones of Mosses in a given locality, on a high mountain, are as capable of accurate definition as those of Phænogams. In tropical climates a favourite situation of many delicate species is the thick coriaceous leaves which are so common there, and so persistent; and even in our own climate, a Moss may now and then occur on evergreen leaves, but then only by accident.

The different nature of soil also, whether from its mechanical division or chemical composition, has a considerable influence on the production of species. The hard beaten sides of foot-paths, the loose crumbling matter at the base of rocks, the sand by the seashore, the rich moist banks of ditches, the grassy meadow, the naked clay, the deep recesses of woods, the peaty soil of heaths and moors, the damp margins of pools or swamps, and wet boggy ground, have their own appropriate species, not to mention the variety of Mosses which are more truly aquatic, whether in rapid streams or quiet waters. The mud-capped walls which are so frequent in oölitic districts produce always a multitude of species, some of them of rare occurrence elsewhere, while the little mounds made by ants are sometimes extremely productive. The *Phasca* seem to luxuriate especially in fallow fields where the soil is thin and not retentive of moisture, especially in calcareous districts. Within a square yard half-a-dozen species may sometimes be found where these conditions exist. Though at a moderate distance from the sea a variety of species may occasionally be found in great perfection, there are very few which, like *Schistidium maritimum*, choose by preference situations constantly exposed to the spray of salt water.

## CHAPTER VII.

## ON THE GEOGRAPHICAL DISTRIBUTION OF MOSSES.

WE have already seen that the distribution of particular species of Mosses in a given area depends greatly upon soil and altitude. When latitude is taken into consideration, conditions will be modified; but within reasonable limits, like circumstances will encourage the growth of the same or similar Mosses. Comparing the Bryology of the British Isles with that of Europe taken as a whole, we find a very large proportion of Continental species diffused amongst them; a very few genera only being unrepresented; while notwithstanding the labours of British Bryologists, there are scarcely half-a-dozen of our Mosses which have not been found on the Continent.\* The times of bearing fruit will differ in different localities; but the characters agree wonderfully with those of the Continental specimens, or where they differ, do not differ more than Continental specimens do from each other.

\* About 280 species out of 716, according to Schimper's enumeration, occur on the Continent which do not occur in the British Isles. The following Continental genera do not occur in our Flora:—*Voitia*, *Sporledera*, *Bruchia*, *Trematodon*, *Angstræmia*, *Conomitrium*, *Pharomitrium*, *Eustichium*, *Braunia*, *Coscinodon*, *Pyramidula*, *Oreas*, *Psilopilum*, *Fabronia*, *Anacamptodon*, *Habrodon*, *Lescuræa*, *Anisodon*, *Platygyrium*, *Theдения*; most of which contain only a single species, and of which the seven last are Pleurocarpous, the rest Acrocarpous.

If we take analogous situations in the southern hemisphere we shall still find a certain proportion of species identical with those of the north, with the admixture however and predominance of distinct forms.

A few species are almost cosmopolitan, as *Andreaea rupestris*, *Weissia controversa*, *Ceratodon purpureus*, *Racomitrium lanuginosum*, *Funaria hygrometrica*, *Bryum argenteum*, *B. capillare*, *Polytrichum commune*, and *Hypnum cupressiforme*. Other British species however occur in various parts of the world which cannot be considered as cosmopolitan.

If we take New Zealand as a point of comparison, a country which is peculiarly rich in Cryptogams, we find that 249 species of Mosses are recorded, in Dr. Hooker's Flora, as occurring in its islands. Of these 41, including the species above-mentioned or about one-fifth, are British or at least European species. In 39 genera there is not a single New Zealand species which is European; and in several of these, as *Macromitrium*, *Racopilum*, *Rhizogonium*, *Dawsonia*, etc., there are no European representatives. Meanwhile *Hookeria*, *Isothecium*, *Homalia*, and some other European genera, obtain an importance which they scarcely possess in any European flora, and indeed Pleurocarpous Mosses are predominant in beauty and luxuriance.

If, however, the New Zealand Mosses be compared with those of Tasmania, we shall find that while the latter, including cosmopolitan forms, comprise about a third of European species, the remainder agree wonderfully with those of New Zealand. Of the 158 recorded species, about 120 are the same with those of New Zealand, without mentioning British forms common to both.

It will be found, moreover, that many of these species of a southern type extend to the Auckland and Campbell's Isles,

and to the southern parts of South America, besides spreading slightly northwards. At the same time tropical forms are few in number, not exceeding five, dispersed through Bourbon, Mauritius, Java, Tahiti, and the Indian continent. About '27 Tasmanian Mosses occur in South Africa, but not generally belonging to the southern types. More tropical forms indeed might have been expected, as there is no severe frost to destroy the young plants, should spores by any accident have been wafted into the country.

A very remarkable deviation from general laws occurs in the centre of Germany. In some situations the great boulders with which the plain is scattered produce alpine species of Moss, as if brought during the glacial period from some distant regions. It is at once obvious that such species as *Andreaea Rothii*, *Catoscopium nigratum*, *Grimmia trichophylla* and *G. leucophylla* are not the natural produce of the plains of Germany, and these are not the only species which show similar anomalies in geographical distribution.

The following orders of Mosses contain no European species, though they combine, for the most part, southern forms, together with others which may be considered Tropical or Subtropical, *Syrrhopodonte*, *Hydropogonei*, *Octoblepharei*, *Leptostomei*, *Rhizogonie*, *Phyllogonie*, *Hypopterygii*, *Racopilacei*. *Fabronia* has two European species amongst numerous exotics.

With the exception of one or two Mosses in amber, we have no certain information as to their occurrence in what are commonly called geological formations.

## CHAPTER VIII.

## ON THE CULTIVATION OF MOSSES.

BUT little has been effected in this direction. A few exotic Mosses are occasionally introduced by accident into our stoves, and in rare cases establish themselves, while some of the more striking exotic forms, as *Octoblepharum albidum*, are imported intentionally with the more minute Ferns, and linger for a year or two in their new home without attracting much attention, while here and there attempts are made to raise Mosses from their spores, more with the intention, however, of watching their mode of development than with a view to their cultivation as objects of ornament.

Few plants, however, will better repay attention. Where British species only are desired, or at least those of temperate regions, a little conservatory with rock-work on either side, capable of being well ventilated, and never heated except in severe weather or to prevent damp, answers the purpose admirably. A few of the smaller Ferns or alpine plants may be introduced with advantage, but nothing of too coarse or rampant a growth. If mixed with some of the more striking Liverworts, to the suppression however of too luxuriant a growth of the common *Marchantia*, which in small quantities will not be unacceptable, a most pleasing effect may be pro-

duced, and one which will be attractive to those who regard form more than brilliant colours. If proper soil were prepared, we have no doubt that the spores of such handsome Mosses as *Splachnum rubrum* and *luteum*, if imported carefully from their northern home, might be made to vegetate and produce their lovely fruit. The subject is, at any rate, worth an effort; and now that there are so many summer visitors to the north of Europe, it may not be difficult to procure living specimens.

The great drawback to the cultivation of Mosses is the appearance of the white mycelium of a parasitic Fungus (*Nectria muscivora*) upon the patches, and possibly of one or two other byssoid productions whose nature has not at present been ascertained. The only mode of dealing with these, as far as we know, is to remove them with a small brush as fast as they are generated, or otherwise unsightly arid blotches are formed which mar the general effect.

A list of Mosses easy of cultivation in a cool frame, or shaded shelf of a greenhouse, is given in Stark's 'History of British Mosses,' p. 44. The pots which contain aquatic species require to be placed in a pan of water. When the pots are removed in summer into the open air they require the protection of a net, as birds are very apt to pull up the Moss in search of insects.

Mosses are not subject to many real parasites, though they form a welcome matrix to many fungi. One or two species, however, inhabit their sporangia or perigonia, while a minute *Fusisporium* sometimes infests the spore-sac, destroying the spores.

## CHAPTER IX.

## ON THE USES OF MOSSES.

IF we confine ourselves to the economical uses of Mosses, we may almost speak of them in the terms in which owls are spoken of in Horrebow's celebrated Chapter in the History of Iceland. *Sphagnum* alone is sometimes ground up to eke out a scanty supply of meal, but without a notion as to its possessing any nutritive qualities. Indeed, scarcely any part of the vegetable kingdom seems to supply so little nutriment to the animal world, though the tufts of Mosses afford harbour to myriads of insects, as they do a warm clothing to the trunks of trees. Scarcely a single species can be mentioned which has any real pretensions to afford a useful medicine; and their other economical uses consist in their supplying an admirable substance for packing or stuffing, or in their capability of being converted into miserable brooms or cushions. One species affords a substitute for lampwicks to the Esquimaux. The continued growth of some of the bog species has a considerable share in the formation of peat, which, after the lapse of ages, is available to man in the shape of fuel.

In the economy of nature they are of immense importance, as they often constitute the first vegetation which appears on new soil, affording a nidus for the development of other

vegetables; and so, at length, in many instances, covering a naked surface with vegetable soil. The minute seeds of *Rhododendra* for instance, where *Mnium punctatum* abounds, find a more genial place of growth in their tufts than in any other locality where those lovely plants seem to be really at home, as in the slate districts of Wales.

This property, however, of clothing naked soils, or of intruding where their presence is not desired, makes them often extremely annoying in the garden, where it is desired to keep gravel-walks trim and unsullied, or in pastures, where they usurp the place of nutritive Grasses. In the former case boiling water impregnated with salt, gas-water, or a solution of some poisonous mineral, may be used with advantage; in the latter the brush-harrow, followed by good manure, will be most likely to effect a cure.

In an æsthetic point of view, it is scarcely possible to speak of Mosses too highly. In elegance and delicacy of colouring they are individually surpassed by few Cryptogams, especially amongst the finer and more attractive kinds; and taken collectively, they frequently give a tone to the colouring of rocks and foregrounds which the eye can at once appreciate. Even some of the smaller species, when in fruit and lighted up *en masse* by a partial sunbeam, are exquisitely beautiful from their red and olive tints.



## CHAPTER X.

## COLLECTION AND PRESERVATION OF MOSSES.

No plants are so easy to prepare for the herbarium as Mosses. They easily part with any moisture which they have imbibed, and if common care is used they are not liable to be spoiled by damp or seriously injured by the depredation of insects. Except in very wet weather, one or two changes of the drying-paper are quite sufficient. In collecting rare or delicate species, especially if they are in a good state of fruit, it is well to wrap the specimens at once, when gathered, in soft paper, which need not be opened till they are required for examination, when the calyptra or more fugitive parts will be preserved, which might otherwise be lost in the process of changing the drying-papers. Where specimens are abundant, it is always well to preserve some in their natural state, except the tufts are unmanageable. A portion however should be carefully disentangled, and thoroughly cleaned from any adherent soil, to show the mode of ramification. Where the fruit is easily destroyed by friction, it is well to keep some separate, in little capsules, gummed to the sheets in which the specimens are placed. It is in general convenient to glue the specimens from different localities on separate pieces of paper, which should either be of one fixed size or multiples of it; and they can

then be pinned into the common sheet or sheets which belong to the particular species. It is an excellent plan, whenever a specimen is examined microscopically, to sketch what is seen on the paper to which it is fastened. This precludes the necessity of repeated examination, and where specimens are rare prevents their being seriously injured.

The most convenient power perhaps for examining the leaves of Mosses is a one-third object-glass, while a one-fifth is quite sufficient for the examination of the peristome. Lower powers however will suffice for the determination of genera and species.

## CHAPTER XI.

## SYSTEMATIC ARRANGEMENT OF MOSSES.

THE main divisions of Mosses depend upon the situation of the fruit, its nature, and the mode of branching; but, as in other branches of natural history, it is impossible in any natural arrangement to frame characters which shall be free from exceptions. They are divided by authors according to these principles into five groups.

1. *Pleurocarpi*. Fruit lateral, springing immediately from the stem.

2. *Cladocarpi*. Fruit terminal, on short lateral branches.

3. *Acrocarpi*. Fruit terminal.

4. *Schistocarpi*. Fruit splitting longitudinally into four or more valves, adhering above.

5. *Syncladei*. Branches fasciculate.

Of these the second is not strictly natural, and the character is difficult of application, as *Acrocarpous* and *Cladocarpous* species occur in the same genus.

It has been proposed moreover to divide the first three groups into *Stegocarpi* and *Cleistocarpi*, the former comprising those in which the spores escape on the separation of the lid, the latter, as in *Phascum*, by the decay or irregular rupture of the sporangium; but as it is probable that in a really

natural arrangement the Phascoid Mosses must be distributed amongst those which are Stegocarpous, the distribution is not tenable.

Generic characters depend upon the structure and situation of the fruit; but though the differences of the peristome afford in many cases admirable characters, in others great latitude must be taken in their use. Where natural groups are sought for, the same genus will sometimes comprise species with a single or double peristome, or in which it is altogether wanting. The old genus *Gymnostomum* is now properly distributed amongst widely distant groups.

The calyptra occasionally affords good characters, but it is sometimes deceptive. The vaginula is often of great importance, but it is not so obvious a source of distinction as parts which are more exposed to view. The comparative length of the lid is often employed as a mark of distinction by Continental authors, but seldom with much advantage.

The male inflorescence rarely affords good generic characters, though it sometimes comes in aid of others, as in *Bryum* and *Mnium*. The reticulation of the leaves is often indicative of natural affinity, and occasionally is available for generic distinctions; but the refinements of Continental Bryologists, especially in the genus *Hypnum*, are not calculated for practical purposes; and though their groups are generally natural, it is often impossible to reconcile them with the proposed distinctions.

The arrangement of Dr. Montagne, in Orbigny's Dictionary, as regards the Natural Orders into which the tribes are divisible, though laying no claim to originality, appears to be one of the most convenient, and was followed in the 'Introduction to Cryptogamic Botany,' and, with few exceptions, is the same with that adopted here.

Where genera approach so near as *Trichostomum*, *Tortula*, and some others, different views will be taken by Bryologists. But in whatever way the several species may be grouped, difficulties will arise as to the stability of characters ; and were those and some neighbouring genera again incorporated, there would still be difficulties as to the natural grouping of the species.

On the whole, the state of Bryology must be considered as extremely imperfect. The entire subject clearly wants the revision of some master-mind.

## SYNOPSIS OF ORDERS AND GENERA.

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It should be observed, that the characters of the Orders and Genera, in the following synopsis, are drawn up with a view to the Mosses of the British Isles alone, and not to Mosses in general, the object being to facilitate the reference of British species to their proper genera. In the enumeration of species, on the contrary, exotic genera and species have been constantly kept in view in the definitions. In scarcely any tribe of plants, however, is it so difficult to draw up precise characters, as the evident affinities of particular species militate more than usually against definite circumscriptions. Generic characters were originally confined to the parts of fructification; but if natural groups are desired, it is absolutely necessary to comprehend also in our characteristic phrases particulars about the mode of branching, and the nature of the leaf-cells, where these admit of definition. In a very few cases I have been compelled to propose genera, where anomalous species did not admit readily of association with others, though I have done so with reluctance.

### SECTION I.—PLEUROCARPI.

Fruit lateral, or at the tips of very short branches.

#### ORDER I. *FONTINALEI*.

Sporangia sessile or subsessile; peristome double; inner peristome conical, cancellate.

Genus 1. *Fontinalis*.—Sporangium sessile; veil mitriform.

Genus 2. *Dichelyma*.—Sporangium sessile or subsessile; veil cucullate.

#### ORDER II. *CRYPTOTHECII*.

Peristome single or double; veil mitriform; stems cylindrical; leaves imbricated.

Genus 3. *Cryphæa*.—Sporangium immersed; veil small; peristome double.

#### ORDER III. *HOOKEREI*.

Sporangium horizontally cernuous, succulent; peristome double; veil mitriform; stem mostly flattened; leaf-cells mostly large.

Genus 4. *Daltonia*.—Sporangium suberect; veil fringed; leaves spreading, cells small.

Genus 5. *Hookeria*.—Sporangium cernuous; inner peristome divided halfway down into sixteen processes, without intermediate cilia; veil not fringed; leaves flattened, cells large.

#### ORDER IV. *NECKEREI*.

Fruitstalk mostly short; peristome double; veil cucullate; leaves mostly flattened; stem more or less pinnate.

Genus 6. *Neckera*.—Sporangium erect, immersed, or exserted; veil large; inner peristome divided almost to the base; leaves mostly undulated.

Genus 7. *Homalia*.—Fruitstalk elongated; inner peristome a membrane divided into sixteen keeled processes without intermediate cilia; leaves not undulated.

#### ORDER V. *HYPNEI*.

Sporangium cernuous; fruitstalk elongated; veil cucullate;

inner peristome mostly with intermediate cilia; stem mostly cylindrical.

Genus 8. *Hypnum*.—Cilia distinct; stem mostly without paraphylla; leaves even.

Genus 9. *Ptychodium*.—Cilia rudimentary; paraphylla numerous.

Genus 10. *Heterocladium*.—Leaves of stem and branches heteromorphous; paraphylla few; upper reticulations narrow.

Genus 11. *Thuidium*.—Leaves of stem and branches heteromorphous; paraphylla numerous; upper reticulations rounded.

Genus 12. *Pseudoleskea*.—Intermediate cilia present or absent; paraphylla numerous; reticulations oval-punctiform.

#### ORDER VI. *ISOTHECII*.

Sporangium erect; fruitstalk elongated; veil cucullate; peristome single or double; leaf-cells minute.

Genus 13. *Isothecium*.—Cilia of inner peristome more or less imperfect; upper leaf-cells linear; secondary stems dendroid.

Genus 14. *Climacium*.—Cilia of inner peristome wanting; veil large; lid adherent to the columella; habit dendroid.

Genus 15. *Cylindrothecium*.—Peristome not hygrometric, inserted below the mouth of the sporangium; inner peristome of sixteen narrow darker teeth; stem decumbent.

Genus 16. *Pylaisia*.—Inner peristome divided almost to the base into sixteen teeth, bipartite or gaping at the keel; intermediate cilia very short; leaf-cells narrow; stem creeping.

Genus 17. *Homalothecium*.—Intermediate cilia none; teeth of outer peristome solid; veil large, subpilose; leaf-cells linear; stem partly creeping, partly assurgent.

Genus 18. *Orthothecium*.—Intermediate cilia short or wanting; teeth of peristome thin; cells at base of leaves not quadrate.



Genus 19. *Myurella*.—Intermediate cilia binate; stem cylindrical; leaves closely imbricated, papillose; leaf-cells minute, chlorophyllous.

Genus 20. *Platydictya*.—Intermediate cilia present or absent; stem coniferoid; leaves loosely set; leaf-cells large.

Genus 21. *Philoscia*.—Intermediate cilia wanting; stem succulent; leaves subbifarious; leaf-cells narrow, elongated.

Genus 22. *Myrinia*.—Inner peristome solid, dark; intermediate cilia wanting; leaves even; leaf-cells large, rhomboid.

Genus 23. *Pterigynandrum*.—Inner peristome rudimentary; veil naked; leaves papillose; upper leaf-cells rhomboid; male and female fruit axillary.

Genus 24. *Antitrichia*.—Fruitstalk short, curved; inner peristome of sixteen perforated teeth adhering to the outer; cilia wanting; leaf-cells minute; stems procumbent, pinnate.

Genus 25. *Thamnium*.—Inner peristome with intermediate cilia; upper leaf-cells elliptic; stem naked below, branched above; branches more or less two-ranked.

Genus 26. *Leucodon*.—Peristome erect, single, or with very obscure traces of an inner membrane; ring fragmentary; leaf-cells punctiform.

Genus 27. *Anomodon*.—Peristome double; inner of sixteen short fugacious processes; leaf-cells very minute, opaque.

Genus 28. *Pterogonium*.—Inner peristome membranous, half as long as the outer teeth, with rudimentary cilia; veil pilose; leaves papillose; leaf-cells elliptic.

Genus 29. *Leskea*.—Peristome double, outer teeth staple-bent when dry; inner peristome with obscure intermediate cilia; leaves papillose; leaf-cells very minute, chlorophyllous.

Genus 30. *Leptodon*.—Peristome double; inner membranous, divided above into short irregular teeth; veil pilose; leaf-cells punctiform.

ORDER VII. *ANÆCTANGIEI*.

Cladocarpous. Sporangium ovate or spherical; peristome none; veil cucullate.

Genus 31. *Anæctangium*.

ORDER VIII. *DREPANOPHYLLEI*.

Mostly cladocarpous. Stems flat; leaves equitant; peristome single, teeth bifid; veil cucullate or conical.

Genus 32. *Fissidens*.—Sporangium often cernuous; fruit-stalk elongated; veil cucullate or conical; teeth sixteen, bifid; divisions slender, elongated; vaginula distinct.

ORDER IX. *MIELICHOFERIEI*.

Cladocarpous. Sporangium straight, with or without an apophysis; peristome single or double; vaginula distinct.

Genus 33. *Mielichoferia*.—Sporangium pyriform or clavate; annulus large; peristome single, of sixteen teeth which are confluent below.

## SECTION II.—ACROCARPI.

ORDER X. *SCHISTOSTEGEI*.

Sporangium subglobose; spore-sac adnate with the walls; peristome none; leaves distichous.

Genus 34. *Schistostega*.

ORDER XI. *SPLACHNEI*.

Sporangium apophysate; spores radiating; leaves diaphanous, large-celled.

Genus 35. *Edipodium*.—Sporangium clavate, confluent with the apophysis and fruitstalk; peristome none.

Genus 36. *Dissodon*.—Apophysis tapering; columella exerted when dry; peristome of sixteen short double teeth incurved when dry.

Genus 37. *Tayloria*.—Apophysis clavate or subpyriform; teeth sixteen or thirty-two, reflexed when dry.

Genus 38. *Tetraplodon*.—Apophysis clavate or ovate; peristome of sixteen double teeth, at first approximated in fours, reflexed when dry.

Genus 39. *Splachnum*.—Apophysis large, spongy, distinct; teeth sixteen, in pairs, reflexed when dry.

#### ORDER XII. *DISCELIEI*.

Sporangium subglobose, cernuous; ring large; teeth sixteen, cloven from the base; veil twisted.

Genus 40. *Discelium*.

#### ORDER XIII. *OREADEI*.

Sporangium small, subglobose, cernuous; peristome single, or obscurely double; veil cucullate.

Genus 41. *Catoscopium*.—Sporangium even, horizontal; peristome of sixteen short teeth, with traces of an inner peristome.

#### ORDER XIV. *BARTRAMIEI*.

Sporangium spherical, mostly striated; leaves rigid, keeled, toothed.

Genus 42. *Conostomum*.—Peristome of sixteen teeth, united at their tips and forming a cone.

Genus 43. *Bartramia*.—Sporangium oblique; veil small, fugacious; peristome double, single, or absent.

Genus 44. *Bartramidula*.—Sporangium even; mouth small; peristome none; spore-sac united above with the columella.

ORDER XV. *FUNARIEI*.

Sporangium pyriform ; veil inflated below, subulate above ; leaf-cells large.

Genus 45. *Physcomitrium*.—Veil 5–6-lobed, with a long, straight beak ; peristome none.

Genus 46. *Entosthodon*.—Veil cucullate ; peristome rudimentary, or of sixteen teeth.

Genus 47. *Funaria*.—Sporangium oblique ; apophysis tapering ; ring very large ; peristome double ; teeth of outer row joined at the tips and forming a cribose disk.

ORDER XVI. *MEESEI*.

Sporangium tapering below, gibbous behind ; fruitstalk very long ; peristome double, not hygrosopic.

Genus 48. *Amblyodon*.—Mouth of sporangium small, oblique ; peristome double, outer of sixteen short teeth, inner longer, deeply divided ; leaves loosely reticulated.

Genus 49. *Meesia*.—Mouth oblique ; peristome double, outer of sixteen short teeth, inner longer, deeply divided ; leaf-cells small, crowded.

Genus 50. *Paludella*.—Sporangium cernuous or suberect ; ring large ; peristome double, outer of sixteen lanceolate teeth, inner a membrane divided halfway down into sixteen processes, without intermediate cilia.

ORDER XVII. *BRYEI*.

Sporangium symmetrical, erect, or cernuous ; peristome double ; veil cucullate ; leaves mostly marginate.

Genus 51. *Cinclidium*.—Inner peristome dome-shaped, with sixteen perforations opposite to the outer teeth.

Genus 52. *Mnium*.—Sporangium ovate or oblong ; peristome

double, inner with intermediate cilia; paraphyses of antheridia clavate; leaves large.

Genus 53. *Zieria*.—Sporangium gibbous behind; neck long; inner peristome longer; intermediate cilia rudimentary.

Genus 54. *Anomobryum*.—Sporangium symmetrical; peristome double; leaf-cells very narrow above, vermiform towards the nerve.

Genus 55. *Bryum*.—Sporangium symmetrical, confluent with the narrow apophysis; paraphyses of antheridia filiform, innovations from the apex; leaf-cells rather large.

Genus 56. *Webera*.—Sporangium symmetrical, confluent with the narrow apophysis; innovations mostly from the base; stems mostly slender; leaves narrow; leaf-cells hexagonal, elongated.

Genus 57. *Leptobryum*.—Sporangium symmetrical, confluent with the narrow apophysis; innovations from the base; leaves very narrow; leaf-cells above hexagonal, elongated. Annual.

Genus 58. *Orthodontium*.—Sporangium symmetrical; spore-case small; peristome double; inner without intermediate cilia; leaves very narrow.

Genus 59. *Aulacomnion*.—Sporangium furrowed, when dry; spores very small.

Genus 60. *Timmia*.—Sporangium symmetrical; peristome double; inner divided halfway into about sixty-four cilia, at first united above.

#### ORDER XVIII. *POLYTRICHEI*.

Sporangium often quadrate; mouth mostly closed with a tympanoid membrane connected with the teeth or wall; veil mostly rough with dependent hairs.

Genus 61. *Polytrichum*.—Sporangium angular, with a dis-

tinct apophysis; spore-sac undulated; veil densely pilose; nerve of leaf covered with longitudinal plaits.

Genus 62. *Pogonatum*.—Sporangium oval or oblong; veil densely pilose; spore-sac undulated; leaves densely lamellate.

Genus 63. *Oligotrichum*.—Sporangium subcylindrical; veil with scattered hairs or apical papillæ; spore-sac undulated.

Genus 64. *Atrichum*.—Sporangium subcylindrical; veil nearly naked, spinulose at the tip; spore-sac adnate with the wall of the sporangium.

#### ORDER XIX. *BUXBAUMIEI*.

Sporangium oblique; peristome a conical membrane surrounded by layers of cellular tissue, divided into irregular teeth, or a rudimentary ring.

Genus 65. *Diphyscium*.—Sporangium subsessile; peristome a twisted plicate membrane, surrounded by a narrow filmy ring.

Genus 66. *Buxbaumia*.—Sporangium large, flat above; peristome a conical plicate membrane surrounded by three or four layers of cellular tissue, divided into irregular teeth; leaves rudimentary.

#### ORDER XX. *TETRAPHIDEI*.

Sporangium straight; peristome confluent with the top of the columella, which is divided into four pyramidal teeth.

Genus 67. *Tetradontium*.—Peristome of four short teeth; leaves minute, lineari-clavate.

Genus 68. *Tetraphis*.—Veil torn at the base; peristome of four triangular-elongated teeth; leaves normal; leaf-cells large.

ORDER XXI. *ZYGODONTEI*.

Sporangium striated ; peristome 0, single or double ; veil eucullate, smooth.

Genus 69. *Zygodon*.—Sporangium apophysate ; veil small, oblique ; peristome 0, single, or double.

ORDER XXII. *ORTHOTRICHEI*.

Sporangium mostly striated ; veil mitriform, plicate, mostly pilose ; peristome variable.

Genus 70. *Orthotrichum*.—Sporangium striate ; veil with a few keel-like folds ; leaves not curled when dry.

Genus 71. *Ulota*.—Sporangium striate ; veil with many folds ; leaves curled when dry.

ORDER XXIII. *PTYCHOMITRIEI*.

Sporangium without a tapering apophysis ; veil smooth, furrowed, subulate ; leaf-cells punetiform, even.

Genus 72. *Ptychomitrium*.—Sporangium slightly tapering below ; veil deeply furrowed, laciniate ; peristome of sixteen deeply-divided teeth.

Genus 73. *Glyphomitrium*.—Sporangium roundish ; veil large, ventricose, plicate, laciniate ; peristome of sixteen teeth, disposed in pairs.

ORDER XXIV. *GRIMMIEI*.

Sporangium equal ; veil mitriform ; leaves mostly with an exeurrent nerve ; upper leaf-cells punetiform.

Genus 74. *Racomitrium*.—Veil multifid below, subulate and papillose above ; ring large ; peristome of sixteen bi-trifid teeth, sometimes divided to the base ; lower leaf-cells narrow.

Genus 75. *Grimmia*.—Veil mitriform or eucullate ; peri-

stome of sixteen lanceolate externally trabeculate bi-trifid teeth, rarely wanting; columella not deciduous; lower leaf-cells larger and diaphanous.

Genus 76. *Schistidium*.—Columella adhering to the lid, and falling away with it.

#### ORDER XXV. *HEDWIGIACEI*.

Sporangium globose or oblong, immersed, or slightly exerted; peristome none; leaves nerveless.

Genus 77. *Hedwigidium*. Sporangium more or less exerted; veil cucullate, smooth.

Genus 78. *Hedwigia*.—Sporangium immersed; veil conical; leaves diaphanous above.

#### ORDER XXVI. *ENCALYPTEI*.

Sporangium straight, even, or striate; veil very large, cylindrical-campanulate.

Genus 79. *Encalypta*.—Fruitstalk elongated; veil mostly appendiculate; vaginula crowned with a conical spongy mass.

#### ORDER XXVII. *RIPARIACEI*.

Peristome of thirty-two teeth, connected together by anastomosing process, or an irregularly fissured or rudimentary membrane; top of columella connected with the peristome.

Genus 80. *Cinclidotus*.—Veil smooth, conical, split on one side; peristome simple, sometimes rudimentary, of thirty-two teeth, rising from a common membranous base, twisted above round the columella.

#### ORDER XXVIII. *TRICHOSTOMEI*.

Veil cucullate; peristome of thirty-two filiform teeth, distinct or united below, frequently in pairs, and sometimes twisted.



Genus 81. *Tortula*.—Veil with a long beak spirally fissured; peristome of thirty-two twisted teeth, united by a tubular short or elongated basal membrane.

Genus 82. *Trichostomum*.—Veil cucullate, smooth; peristome of thirty-two teeth, disposed in pairs, composed of a single series of elongated cells, sometimes united and perforated, connected below by a short membrane; leaf-cells punctiform above, minutely papillose.

Genus 83. *Leptotrichum*.—Peristome of thirty-two teeth, disposed in pairs, or sometimes reduced to sixteen; leaf-cells narrow, elongated, not papillose.

Genus 84. *Didymodon*.—Veil cucullate, covering at least half the sporangium; peristome rather short, of sixteen linear-lanceolate teeth, consisting of a double row of cells, tender and fugacious, entire, or perforated; leaf-cells narrow.

Genus 85. *Distichium*.—Veil cucullate with a slender beak; peristome of sixteen teeth inserted below the mouth of the sporangium, transversely barred, entire, or perforated; leaves more or less distichous; upper leaf-cells minute.

Genus 86. *Desmatodon*.—Veil rather large, cucullate; peristome of sixteen subulate teeth, united at the base by a short membrane, often split above, with the divisions free, or united by trabeculæ; upper leaf-cells elongated; lower very large.

#### ORDER XXIX. *POTTIEI*.

Sporangium straight; peristome wanting, or of sixteen teeth; veil cucullate; upper leaf-cells large, hexagonal, lower rectangular.

Genus 87. *Anacalypta*.—Peristome of sixteen teeth, united below by a common membrane, entire, or imperfectly divided, sometimes fragmentary.

Genus 88. *Pottia*.—Veil cucullate; peristome none; apex of columella falling away with the lid.

ORDER XXX. *DICRANEI*.

Sporangium even or striate; peristome of sixteen bifid, often transversely-striate teeth; veil cucullate, entire, or fringed.

Genus 89. *Campylopus*.—Sporangia mostly aggregate; fruitstalk curved or geniculate; veil fringed; teeth lanceolate; leaf-cells subquadrate.

Genus 90. *Dicranodontium*.—Sporangium even; fruitstalk curved; veil not fringed; upper leaf-cells narrow.

Genus 91. *Ceratodon*.—Sporangium erect, furrowed; peristome of sixteen deeply cloven teeth, connected below by transverse processes; upper leaf-cells minute.

Genus 92. *Trichodon*.—Fruitstalk flexuous; sporangium even; peristome of sixteen teeth divided to the base; articulations nodose; leaf-cells rectangular.

Genus 93. *Leucobryum*.—Sporangium striate; peristome of sixteen bifid trabeculate teeth; outer leaf-cells perforated.

Genus 94. *Dicranum*.—Sporangia aggregate or single in the same perichætium; teeth sixteen, striate and trabeculate; upper leaf-cells linear.

Genus 95. *Dicranella*.—Sporangium mostly cernuous; veil slightly inflated; peristome regular; upper leaf-cells oblongo-hexagonal; stems normally short.

Genus 96. *Dichodontium*.—Sporangium roundish, without any apophysis; fruitstalk flexuous; teeth bi-trifid; articulations crowded, prominent; upper leaf-cells very minute, quadrate, papillose.

Genus 97. *Cynodontium*.—Sporangium oblique or symmetrical; veil rather large; teeth lanceolate, dilated at the base, cloven, often irregular; upper leaf-cells minute; lower rectangular; all chlorophyllous.

Genus 98. *Arctoa*.—Sporangium short, furrowed when dry; veil inflated; teeth narrow, unequally eloven or perforated; leaf-cells elongated.

Genus 99. *Blindia*.—Sporangium roundish, turbinate when dry; veil at first angular below; leaf-cells reetangular.

Genus 100. *Stylostegium*.—Sporangium roundish, immersed; veil very short; peristome none; upper leaf-cells oblong.

#### ORDER XXXI. *WEISSIEI*.

Sporangium erect, equal; peristome 0, or of sixteen, mostly entire teeth, often united at the base; leaf-cells mostly minute above or quadrate.

Genus 101. *Anodus*.—Sporangium straight, truncato-ovate; columella at length exserted; peristome none.

Genus 102. *Seligeria*.—Sporangium roundish, wide-mouthed; teeth 16, obtuse.

Genus 103. *Brachyodus*.—Sporangium furrowed when dry; ring broad; teeth very short, truncate, partly confluent.

Genus 104. *Campylostelium*.—Fruitstalk curved; veil five-cleft; ring double; teeth long, connected below, eloven above.

Genus 105. *Rhabdoweissia*.—Sporangium erect, striate; teeth narrow; ring very narrow; leaf-cells subquadrate above.

Genus 106. *Weissia*.—Sporangium erect, even; teeth mostly free at the base without a medial line, entire, bifid, or perforated; upper leaf-cells minute.

Genus 107. *Gymnostomum*.—Sporangium erect; veil large, rostrate; peristome none, or the rim of the orifice adheres to the top of the columella.

Genus 108. *Syctegium*.—Fruitstalk short; lid persistent but separating easily when mature; spores rather small, globose.

ORDER XXXII. *PHASCEI*.

Sporangium indehiscent; peristome none.

Genus 109. *Pleuridium*.—Fruitstalk short; sporangium apiculate, lateral after innovation; upper leaf-cells narrow.

Genus 110. *Phascum*.—Columella persistent; veil regularly cucullate; prothallus fugacious; upper leaf-cells rather lax.

Genus 111. *Bryella*.—Sporangium roundish, exserted; lid defined; ring adnate; veil cucullate, scabrous above; upper leaf-cells chlorophyllous.

Genus 112. *Cycnea*.—Sporangium globose; fruitstalk curved upper leaf-cells minute, subquadrate.

Genus 113. *Sphærangium*.—Sporangium globose, erect, or pendulous; veil mitriform; spore-sac separable; leaf-cells large; prothallus fugacious.

Genus 114. *Microbryum*.—Sporangium subovate; veil large, many-lobed; leaf-cells small, rhomboid.

Genus 115. *Physcomitrella*.—Sporangium globose; columella thick; veil campanulate, at first subvesicular; leaf-cells large, hyaline.

Genus 116. *Ephemerella*.—Prothallus persistent; sporangium immersed; veil cucullate; spores large; upper leaf-cells subhexagonal.

Genus 117. *Ephemerum*.—Prothallus persistent; sporangium immersed; veil mitriform; spores large; leaf-cells large, hyaline.

Genus 118. *Archidium*.—Sporangium globose; lid none; columella fugacious; veil torn in the centre; spores very large, few in number.

## SECTION III.—SYNCLADEI.

Branches fasciculate; fruit at length cladocarpous; receptacle elongated.

ORDER XXXIII. *SPHAGNEI*.Genus 119. *Sphagnum*.

## SECTION IV.—SCHISTOCARPI.

Sporangium quadrifid or multifid; receptacle elongated.

ORDER XXXIV. *ANDREÆI*.Genus 120. *Andreaea*.—Sporangium quadrifid.

FAMILY I.—PLEUROCARPI, *Bridel.*

Sporangium lateral, springing from the axillary or subaxillary bud.

**A. EUPLEUROCARPI.** *Truly pleurocarpous; vaginula, except in Anœctangium, more or less confluent with the perichæatial branch.*

ORDER I. *FONTINALEI*, Br. et Sch.—Mont.

Aquatic, attached at the base, floating above. Sporangium nearly sessile, immersed amongst the perichæatial leaves. Perichæatial branchlets not rooting at the base. Peristome, when present, double; inner cancellated.

Allied evidently to *Cryphæa*, *Climacium*, and the splendid exotic genus *Spiridens*.

1. *FONTINALIS*, *Dill.*

Dioicous. Sporangium immersed. Veil short, mitriform, toothed, or slightly torn at the base. Outer peristome of sixteen long, narrow teeth, articulated, trabeculate within; inner of sixteen cilia, united by transverse processes into a conical network, and studded within with projecting points.

*Stem branched bifariously, branches sometimes fasciculate; leaves nerveless, concave, or keeled, in three ranks.*

1. *F. antipyretica*, *L.*; stems with their leaves triquetrous; leaves sharply keeled, the margin on one side reflected; sporangium wholly immersed.—*Hook. & Wils. t. xxii.*; *Eng. Bot. t. 359*; (Plate 3, fig. 2;) *Moug. et Nest. n. 238.*

On stones and wood in streams or in stagnant pools, in flat or mountainous countries. Common. Bearing fruit in summer.

Stems triquetrous, from several inches to one or two feet in length, purplish, leafy above; leaves ovate, pointed, entire, or obscurely toothed, nerveless, strongly keeled and complicated, so as to be triquetrous, dark green when old; occasionally there are two or three fine projecting filiform processes toward the tip instead of the obscure teeth; sporangia immersed amongst the obtuse perichæatial leaves, almost sessile; peristome bright red, presenting a beautiful object under the microscope. As the leaves are often split along the keel, care must be taken not to confound this with the following species. Two distinct varieties occur, the one with "more slender, fasciculate, not spreading branches, and less complicated leaves," the other with "wide spreading, broad, flaccid, and transparent leaves."

The plant derives its specific name from its being used in the North of Europe as a stuffing between the wooden walls of huts and the chimney, in consequence of its not being easily inflammable. It is also sometimes used in the same districts, boiled in small beer, as a foot-bath in some pectoral complaints.

2. *F. squamosa*, *Dill.*; branches fasciculate, naked at the base; leaves more or less lanceolate, concave.—*Hook. & Wils. tab. xxii.*; *Eng. Bot. t. 1861*; (Plate 3, fig. 1;) *Moug. et Nest. n. 430.*

In alpine rivulets often mixed with *F. antipyretica*. Not uncommon, but generally barren. When fertile, bearing fruit in summer.

A smaller plant than the last, darker, and with shorter stems, whose branches are more inclined to be fasciculate. The leaves moreover are not keeled, nor is their margin bent back. It must not be confounded with specimens of the last,

in which the leaves are split in the direction of the keel. In both, the perichæatial leaves are serrated or eroded at the apex. Two other species of this genus occur in Europe.

## 2. DICHELYMA, *Myrin.*

Dioicous. Sporangium exserted (or immersed). Veil hood-shaped, elongated. Peristome as in *Fontinalis*, but the inner less cancellated. *Branches two-ranked (or irregular); leaves narrow, nerved.*

1. *D. capillaceum*, *Br. et Schimp.*; branches two-ranked; leaves scarcely falcate, ovato-lanceolate, extremely narrow towards the apex, and serrated; nerve excurrent; sporangium lateral; inner peristome cancellated above only.—*Hook. & Wils. tab. xxii.*; *Eng. Bot. t. 2432.*

In alpine rivulets. Said to have been found by Dickson, but it has not been observed since his time, and it is conjectured that foreign specimens were inadvertently substituted for his plant when communicated to bryologists. *Blindia acuta*, when growing in water, has sometimes been confounded with it, and this may possibly have been what Dickson really gathered.

Three species are recorded as European, of which two only have been found in fruit. They resemble in habit such *Hypna* as *H. aduncum* or *H. fluitans*. The fruit grows laterally from the perichæatial branch, the leaves of which are convolute. In *Dichelyma falcatum*, which has never been supposed to be a native of this country, the sporangium is much exserted, springing terminally from the elongated perichæatial branch, and the inner peristome is more like that of *Fontinalis*.



ORDER II. *CRYPTOTHECII*, Br. & Sch.—*Pilotrichei*, Müll.

Stem not flattened; leaves pointing in every direction; veil mitriform; peristome wanting, single or double.

### 3. *CRYPHÆA*, *Mohr*.

Monoicous; stem mostly more or less pinnate, springing from a creeping rhizoma; sporangium immersed; veil small, conico-mitriform, generally more or less rough, more or less incised at the base; vaginula none; peristome double; outer of sixteen teeth, inner of sixteen processes, alternating with the teeth, united below by a short membrane. *Arboreous or aquatic*.

1. *C. heteromalla*, *Bridel*; primary stem creeping, pinnate; fertile branches erect, slightly branched; leaves ovate, more or less acute, concave, with the nerve reaching to the centre; margin reflexed; sporangium unilateral; peristome nearly white.—*Hook. & Wils. t. xxii.*; *Eng. Bot. t. 1180.*; (Plate 3, fig. 3); *Moug. & Nest. n. 732*.

On trunks of trees, in woods. Not uncommon.  $\beta$  on stones, and at the base of trees in or near rivulets, as in Devonshire. Bearing fruit in early summer.

About an inch long. Leaves spreading, broadly ovate, acute or acuminate; sporangia on short perichæatial branches, apparently unilateral, and often crowded, oblong, with a short stalk, yellowish, becoming rufous when old; ring large, deciduous; veil slightly rough; lid conical, pointed, half as long as the sporangium, brighter-coloured.

The aquatic form is stouter, and has more obtuse leaves whose margins are not reflexed, and is found at the base of trees on the water-side, or on stones, but does not differ in any essential characters. There are several exotic species, but only one European representative of the genus.

ORDER III. *HOOKEREEI*, Br. & Sch.

Stem mostly flattened with bifarious large-celled leaves, creeping, irregularly branched, rarely cylindrical and suberect, with the leaves pointing in every direction; sporangium horizontally cernuous, thick, on a succulent elongated stalk; veil smooth, campanulate; peristome double.

4. *DALTONIA*, *Hook. & Tayl.*

Leaves pointing in every direction, with elongated cells; sporangium cernuous or suberect; lid large, rostrate; veil mitriform, fringed below with several rows of cilia; peristome double; external of sixteen teeth, inner of sixteen cilia, of equal length, nearly distinct at the base. *Small, tufted, mostly exotic Mosses.*

1. *D. splachnoides*, *Hook. & Tayl.*; branches short, fastigiate; leaves crowded, lineari-lanceolate, acute, somewhat keeled, the nerve vanishing below the tip; margin thickened; sporangium suberect, oval, oblong, with a distinct apophysis; outer teeth generally perforated. — *Hook. & Wils. t. xxii.*; *Eng. Bot. n. 2564.*; (Plate 3, fig. 4.)

On moist rocks and trees in one or two localities in Ireland, but not yet found on any part of the Continent. Bearing fruit in winter.

About  $\frac{1}{4}$  of an inch high; monoicous and bisexual; branches tufted, suberect; leaves crowded, dark green; sporangium purple-brown, with a small but distinct swelling at the base; fruitstalk minutely granulated; peristome large; outer of 16 yellow teeth, perforated in the centre; inner of 16 keeled cilia, distinct at the base.

There are several exotic species of this genus, which is extremely rare in Europe, and indeed confined to Ireland. The

quaquaversal leaves approximate it to *Cryphæa*, while together with their different texture they distinguish it from other *Hookerii*, and in consequence a distinct division (*Daltonii*) is made for its reception, together with some allied exotic genera by Schimper.

### 5. HOOKERIA, *Smith*.

Stem irregularly branched or subpinnate; leaves flattened; sporangium more or less eernuous; veil smooth, elongated, mitriform; peristome double; outer of sixteen teeth, inner a membrane divided halfway down into sixteen keeled processes, without intermediate cilia; mostly monoicous. *Perennial Mosses growing in the shade, on the ground, or on trees.*

1. *H. lucens*, *Smith*; stem irregularly branched; lower leaves narrow, subrotund, upper much larger, ovate, oblong, obtuse, nerveless.—*Hook & Wils. t. xxvii.*; *Eng. Bot. t. 1902.*; (Plate 3, fig. 5); *Moug. & Nest. n. 40.*

On moist banks in the southern counties; rare, or entirely wanting in higher latitudes. Bearing fruit in winter.

Monoicous. Stems 2 or 3 inches long; branches flattened; leaves flat, imbricated, of a beautiful pale green, shining, quite entire, very obtuse, nerveless; sporangium elliptic, rather small in proportion to the rest of the plant, horizontally eernuous, thick, and succulent; lid long, with a straight beak; veil large, thick, slightly split at the base; outer teeth reddish-brown, with prominent trabeculæ within; inner with abortive cilia between the processes which are perforated along the medial line.

Perhaps the most beautiful of British Mosses, and abundant in some counties. The cells of the leaves are remarkably large, and the loose chlorophyll contracts when dry. This and the closely allied American *H. acutifolia*, are separated

by Bridel, under the name of *Pterygophyllum*, more on account of habit than essential character. Bridel also refers the next species to it, which is retained in *Hookeria*, by Schimper. If the genus is ultimately adopted, it will be one amongst many instances in which the species to which the generic name was first applied, has been excluded from its own genus.

2. *H. læte-virens*, *Hook. & Tayl.*; stem procumbent, sub-pinnate; leaves suddenly acuminate, ovate or ovate-oblong, with a thickened margin, sharply toothed, binervate.—*Hook. & Wils. t. xxvii.*; *Eng. Bot. t. 2672.*; (Plate 3, fig. 6.)

In shady places near rivulets and caves, in two or three localities in Ireland. It has also been found near Penzance by Mr. Ralfs. It is unknown on the Continent. Bearing fruit in winter.

Monoicous; forming loose, rather flattened tufts of a deep green, or occasionally yellowish. Stem an inch or more long; leaves much smaller than in the last, with much smaller cells, somewhat waved when dry, opaque, not shining, margined, with two divergent nerves springing from the base, and extending halfway up; veil small, covering only the upper part of the lid; sporangium small, drooping; lid of the same length, with a straight beak; outer teeth with two ridges on the back, in which respect the peristome is very different from that of the last, which approaches very near to that of *Hypnum*.

ORDER IV. *NECKEREI*, Mont.—*Omalieæ*, Br. & Sch.

Stem mostly compressed and pinnate; fruitstalk usually short, sometimes obsolete; peristome double; veil hood-shaped.

6. *NECKERA*, *Hedw.*

Stem pinnate, flat; leaves mostly undulated; sporangium erect, symmetrical, immersed or exserted; peristome double;

outer of sixteen teeth, each with a medial line; inner of narrow, keeled processes, connected at the base. *Perennial Mosses growing on trees or on stones.*

a. *Monoicous.*

1. *N. pennata*, *Hedw.*; secondary stems pinnate, flat; leaves ovato-lanceolate acuminate, nearly entire, nerveless; sporangium ovato-oblong, immersed in the perichæatial leaves. —*Hook. & Wils. t. xxxiv.*; *Grev. Scott. Crypt. Fl. t. 109.*; (Plate 4, fig. 4); *Moug. & Nest. n. 146.*

On trunks of trees in subalpine districts. Found once only in Scotland, and once in Ireland. Bearing fruit in spring.

Stems 2 inches or more long, creeping, branched; the branches erect, pinnate, sometimes simple, often much attenuated at the tip; leaves flat, the outer ones spreading, ovate or ovato-lanceolate, concave at the base, slightly undulated, of a pale green, shining, very minutely serrate towards the tip or quite entire, nerveless or occasionally with two faint nerves at the base; cells elongated; perichæatial leaves in which the sporangium is immersed more elongated; sporangium ovato-oblong; lid shorter, oblique, rostrate; veil whitish, hood-shaped; peristome nearly colourless; outer teeth lanceolate, inner filiform, extremely delicate, short, and fugacious, often more or less attached to the outer.

Differs from the other British species in its monoicous inflorescence, and immersed sporangia. It is very widely diffused, and occurs in the southern as well as the northern hemisphere. The fruit is perfect in early spring. A closely allied species, *N. oligophylla*, occurs in the north of Europe and Canada, which is distinguished by its minute, subglobose sporangia, shorter, less pinnate, often simple branches, very rugged, narrower, and suddenly acuminate, less crowded leaves, which

are decidedly serrate, as well as by its growing on rocks, not on trees.

b. *Dioicous*.

2. *N. pumila*, *Hedw.*; branches flat; leaves ovate or ovate-oblong, often apiculate, minutely serrate above, nerveless or faintly two-nerved, slightly undulated, margin recurved; sporangium oblongo-elliptic, exserted; fruitstalk short; lid equal, shortly rostrate.—*Hook. & Wils.* xxii.; *Eng. Bot. t.* 1443.; (Plate 4, fig. 3); *Moug. et Nest. n.* 429.

On trunks of trees, or occasionally on rocks. Not common, though it occurs here and there, from Inverary to Hampshire. Bearing fruit in winter. It is abundant about the Lakes of Cumberland and Westmoreland, but mostly without fruit. On the Continent it generally grows on the trunks of Conifers.

Stems 1–2 inches long, with short, flat, spreading branches, sometimes much attenuated at the tips (flagelliform); leaves ovate or ovate-oblong, concave, with the margins recurved, slightly serrate above, acuminate or suddenly apiculate, with a flexuous tip, mostly nerveless, but sometimes having two short divergent nerves at the base; cells elongated; sporangia on short fruitstalks, which surmount the perichætical leaves, oblongo-elliptic, contracted above; lid about half as long, acuminate; outer teeth of peristome reddish, inner which are attached to a short membrane, yellowish, filiform.

This is a far smaller plant than *N. crispa*, from every variety of which it is easily known by the margin of the leaves being recurved, and the shorter fruitstalk. They are usually far less undulated, but they vary in this respect. The species occurs in North America.

3. *N. crispa*, *Hedw.*; stems more or less pinnate; leaves crowded, flattened, ovate-oblong, apiculate, deeply undulated

transversely, minutely toothed above, glossy, nerveless, or with one or two short, faint nerves at the base; fruitstalk elongated.—*Hook. & Wils. t. xxii.*; *Eng. Bot. t. 617.*; (Plate 4, fig. 2); *Moug. & Nest. n. 48.*

On rocks and stones, in alpine or subalpine, especially calcareous districts, more rarely on the trunks of trees. Bearing fruit in winter and spring.

Forming large, yellowish, bright green, or occasionally reddish-brown, elastic tufts, several inches in breadth, more or less pinnate, sending down stolons below; leaves flattened, rather crowded, ovate-oblong or tongue-shaped, concave at the base, nerveless or with one or two short nerves, acuminate or suddenly apiculate, entire below, minutely serrate above, transversely and often concentrically undulated; fruitstalk elongated; sporangium ovate or globoso-ovate; lid with a long, oblique beak; veil smooth or slightly hairy, longer than the lid; peristome pale.

This is one of our finest Mosses, and very striking when it forms large patches on the *débris* of limestone rocks, as at Gwrwch Castle, in Denbighshire. Mr. Wilson speaks of a stunted variety, with nearly circinate stems, which occurs on the tops of mountains in Scotland and Ireland. The species is widely distributed throughout Europe.

4. **N. complanata**, *Br. & Sch.*; branches short, often flagelliform; leaves flattened, oblong, not undulated, suddenly apiculate, minutely toothed at the tip; sporangium oval, erect; fruitstalk elongated; lid beaked.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1492.*; (Plate 4, fig. 1); *Moug. & Nest. n. 328.*

On the trunks of trees, in woods, and occasionally on stones. Widely distributed. Bearing fruit in winter.

Forming little dense tufts from 1 to 6 inches long, or spread out flat, especially when growing on the trunks of trees;

stems pinnate, with short, often flagelliform, flattened, simple or pinnate branches; leaves oblong or tongue-shaped, abruptly apiculate, not undulated, nerveless or with two short nerves at the base, the apex toothed; leaf-cells narrow, elongated, showing the primordial vesicle very distinctly; fruitstalk projecting far beyond the perichaetial leaves; sporangium elliptical, erect, symmetrical; lid long, with an oblique beak; veil with a long abrupt beak, smooth or slightly hairy, covering the sporangium.

This species has very much the habit of *Homalia*, differing from *Neckera* in not having undulated leaves, but agreeing in the inner peristome being divided almost to the base. The cells of the leaves, though the structure is essentially the same, are also more crowded and narrower than in *Homalia trichomanoides*, to which it has much external resemblance. It differs from that remarkably in being dioicous. It is found in North America. Though a common species, it rarely produces fruit.

#### 7. HOMALIA, *Brid.*

Sporangium unsymmetrical; fruitstalk elongated; veil hood-shaped, peristome double, outer of sixteen teeth trabeculate within, inner a membrane divided above into sixteen processes, without intermediate cilia; leaves flat, not undulated.

Schimper is inclined to place this genus in a distinct Order from its connection with some exotic forms, but the needless multiplication of Orders as well as genera is, we think, to be greatly deprecated. The name is derived from  $\delta\mu\alpha\lambda\acute{o}\varsigma$ , plane, in allusion to the flattened leaves.

1. *Homalia trichomanoides*, *Br. & Schimp.*; irregularly pinnate; leaves flat, at length curved down, oblongo-falciform, obtuse, minutely toothed above, with one often obscure nerve



reaching halfway up; lid beaked.—*Hook. & Wils. tab. xxiv.*; *Eng. Bot. t. 1493.*; (Plate 4, fig. 5); *Moug. & Nest. n. 139.*

On stones, rocks, trunks of trees, etc., in moist woods. A common species widely diffused through Europe, except in the drier parts. The fruit is ripe in autumn.

Monoicous; forming small, elastic tufts which are curved downwards when dry; irregularly pinnate; branches flat, of a bright shining green; leaves oblong, more or less sickle-shaped, obtuse, serrated about halfway; nerve reaching halfway up, often very faint, and sometimes scarcely at all traceable; cells not so elongated as in the foregoing species; sporangium nearly erect, slightly unequal, on a long fruitstalk; lid with a long, oblique beak, almost as long as the capsule; veil hood-shaped; outer teeth brownish, inner yellow, perforated.

There is a closely allied species in North America.

#### ORDER V. *HYPNEI*, Br. & Schimp., Mont.

Stem mostly imbricated and cylindrical; sporangium mostly unsymmetrical, cernuous; fruitstalk elongated; peristome double, inner with sixteen teeth and intermediate eilia; veil hood-shaped.

#### 8. *HYPNUM*, *Dill.*

Sporangium unsymmetrical; peristome double; outer of sixteen teeth trabeculated within, inner a membrane divided halfway down into sixteen keeled, often perforated processes, with intermediate eilia, either solitary or two or three together; stem mostly without paraphylla.

This large genus, like *Agaricus* amongst Fungi, is divisible into a number of distinct groups, which are regarded by authors according to their respective views as distinct genera or subgenera. I prefer greatly the latter course, and while I

adopt the divisions given in Schimper's last work, I retain the name of *Hypnum* as generic, a course which has also been followed in Wilson's 'Bryologia.' As regards species, I conceive that they have been multiplied far beyond the true requisitions of science. In a very few cases the branches are flattened, but an examination of the peristome will at once show their true affinities.

I have as nearly as possible followed the arrangement of Wilson, which accords wonderfully as to its divisions with the generic sections of Schimper, a circumstance which is, to a certain extent, a proof that these are natural. In a few instances only I have followed Schimper in eliminating a few species, where the characters really seemed good, and in bringing back one or two species which seem to have been separated contrary to nature. As the genus *Hypnum* is retained in its integrity, I have followed very nearly the order prescribed by Wilson, though the last species in the genus are more nearly allied to the preceding genera than the first. If the contrary order were taken, we should have the inconvenience of giving first those species which depart most from the generic character, though perhaps the first in point of dignity.

#### CONSPECTUS OF THE DIVISIONS OF THE GENUS *HYPNUM*.

Sect. I. Leaves spreading in all directions, not decidedly complanate, secund or assurgent.

A. Stem creeping, irregularly branched, or occasionally arched and pinnate.

\* Leaves acute; nerve reaching at least halfway, except in two species.

† Leaves plicate, sulcate, or decidedly striate.

†† Leaves even, or only slightly striate.

a. Fruitstalk scabrous.

‡ Lid conical or acute.

‡‡ Lid rostrate.

b. Fruitstalk even, without any roughness.

+ Lid rostrate.

+ + Lid conical or acute.

\*\* Leaves acute, mostly squarrose, mostly short-nerved or nerveless

\*\*\* Leaves roundish, rather obtuse, entire, mostly two-nerved or nerveless.

B. Stem erect, pinnate; fruitstalks from upper half of stem.

\* Leaves nerveless or two-nerved, entire.

\*\* Leaves nerved halfway.

C. Stem erect, simply, doubly, or triply pinnate, tomentose or rough with paraphylla; fruitstalks from upper part of stem.

\* Leaves papillose.

\*\* Leaves even, without papillæ.

Sect. II. Leaves decidedly secund.

A. Stem more or less erect, pinnate; leaves falcato-secund.

\* Leaves nearly entire, nerve reaching halfway or more.

\*\* Leaves decidedly serrate, nerve reaching halfway or more.

\*\*\* Leaves more or less striate, nerveless or two-nerved, toothed.

B. Stem proeumbent, more or less pinnate; fruit near the base.

C. Leaves turned upwards, assurgent.

Sect. III. Leaves decidedly complanate; stems proeumbent; fruit radical.

Sect. I. *Leaves spreading in all directions.\**

A. *Stem creeping, irregularly branched, or occasionally arched and pinnate.*

\* *Leaves acute, nerve reaching at least halfway.†*

† *Leaves plicate.*

a. CAMPTOTHECIUM, *Schimper.‡*

1. *H. lutescens*, *Dill., Huds.*; stem prostrate or ascending, variously branched; branches erect or depressed; leaves lanceolate, plicate, minutely toothed above, nerve reaching above the middle; sporangium cernuous; fruitstalk rough; lid conical, shortly beaked.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1301.*; (Plate 5, fig. 2); *Moug. & Nest. n. 334.*

On calcareous rocks, on the borders of woods, in old stone-pits, and on sandy banks, especially near the sea. Common. Bearing fruit in spring.

Monoicous; forming dense, yellow or tawny, shining tufts;

\* In *Hypnum depressum* the leaves are flattened, as in the last section.

† Habit of *Brachythecium*, leaf-cells of *Hypnum*, Schimper.

‡ In *H. demissum* and *depressum* the leaves are either nerveless or have two faint nerves.

stems prostrate or ascending, sometimes forked above, sometimes irregularly branched or imperfectly pinnate; leaves lanceolate or ovato-lanceolate, plicate, straight, or rarely slightly secund when the branchlets are curved, minutely toothed above; nerve vanishing a little below the summit; cells very narrow and elongated; fruit abundant; fruitstalk cylindrical, elongated, granulated; sporangium oblique, oblongo-cylindrical, cernuous, slightly curved when old; lid conical, decidedly rostrate.

The decidedly plicate leaves, scabrous fruitstalk, and rostrate lid are the distinguishing characters of this species.

2. *H. nitens*, *Schreb.*; stems erect, tomentose, tufted; leaves erecto-patent, lanceolate, acuminate, entire, plicate; nerve reaching more than halfway; sporangium cernuous, curved; lid conical.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1646.*; (Plate 4, fig. 6); *Moug. & Nest. n. 517.*

In marshy, boggy ground, and peat bogs, rarely bearing fruit in England, though in some parts of the Continent it is abundant. Fruit ripe in summer.

Dioicous; forming erect, yellow-green or tawny, shining tufts,  $1\frac{1}{2}$ -3 inches high, irregularly pinnate; stems clothed with purplish, branched, articulated threads; branches sharp-pointed; leaves erecto-patent, lanceolate, strongly acuminate above, entire, deeply grooved, with a nerve reaching nearly to the summit; margin even or slightly recurved; cells very narrow; fruitstalk elongated, growing towards the top of the stems, even; sporangium strongly curved, cernuous, reddish-brown, or party-coloured; lid conical, acute.

Easily recognized from the last by its downy stem, and smooth fruitstalk. It has some resemblance in habit and in the form of the sporangium to *Hypnum cuspidatum*.

β. BRACHYTHECIUM, *Schimp.\**

3. *H. salebrosum*, *Hoffm.*; stem decumbent; branches erect; leaves crowded, pointing in every direction, lanceolate, acuminate, plicate, toothed above; nerve reaching a little above the middle; fruitstalk even; sporangium cernuous; lid acutely conical.—*Hook. & Wils. t. 1v.*; *Eng. Bot. t. 2800.*; *Grev. Scot. Crypt. Fl. t. 184*; (*Moug. & Nest. n. 834.*)

On rocks, walls, or the roots of trees, on the ground in woods, and on grassy, sandy banks. Apparently rare, though found from Scotland to Sussex. Fruit ripe in autumn.

Monoicous; forming dense, pale-green tufts, 2–3 inches long, decumbent with erect, somewhat pinnate branches, which are without any down; leaves ovato-lanceolate, elongated, strongly acuminate, grooved rather than plicate, serrated above, and indeed sometimes to the base; nerve reaching more than halfway up; cells narrow, hyaline; margin slightly recurved; fruitstalk about an inch long; sporangium arcuate, cernuous, with a sharp conical lid.

Many varieties are recorded by Schimper through which it approaches *H. glareosum* on one side and *H. rutabulum* on the other. The leaves, though strongly acuminate, are not twisted, as in *H. glareosum*, nor is the acumination so long; besides which, they are more manifestly serrated. From *H. albicans* it differs in colour and the serrated tips of the leaves; from *H. lutescens*, manifestly in its smooth fruitstalk. The specimens in Moug. and Nest., at least in my copy, approach very near to *H. glareosum*, the tips of the leaves being very slender and scarcely at all serrate. Their reticulation is, however, much closer.

\* Distinguished from the last by Schimper on account of the looser areolation and evident primordial cells.

4. *H. glareosum*, *Bruch, mss.*; stem procumbent or ascending, irregularly divided; leaves crowded, pointing in every direction, ovate, with a very long, often twisted, nearly entire point, sulcate; nerve slender, reaching above the middle; sporangium curved, lid conical.—*Hook. & Wils. t. xxxv. lv.*; (*Moug. & Nest. n. 1133.*)

On shaded, gravelly grassy banks. Occasionally from Lancashire to Yorkshire. Bearing fruit, but rarely, late in autumn or winter.

Dioicous; forming depressed or cæspitose, silky masses of a whitish green. Stems about 2 inches long, procumbent or ascending, loosely branched or occasionally slightly pinnate; leaves ovate, erecto-patent, grooved, ovate or ovato-lanceolate, with a very acuminate, almost hair-like, often twisted point, which is more or less serrate above only, the nerve slender, and reaching more than halfway up; leaf-cells narrow, but not so much so as in the last; margin slightly reflected towards the base; sporangium oblong, curved, cernuous, reddish-brown, at length black; lid conical, very acute; fruitstalk smooth, reddish, about an inch long.

Closely allied to the last, but distinguished by its dioicous inflorescence, the looser texture of the more acuminate, less serrated leaves, the paler colour, etc. It will be seen from the two figures quoted above how much the serrature varies. In specimens from Cottrel, I find it just intermediate between the two.

5. *H. albicans*, *Dill., Neck.*; stem erect, loosely tufted, slightly branched; leaves pointing every way, ovato-lanceolate, acuminate, entire, sulcate, nerve reaching beyond the middle; sporangium ovate, cernuous, lid conical, acute.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1300.*; (Plate 5, fig. 1); *Moug. & Nest. n. 236.*

In dry grassy places, on thatched roofs, but more especially on sand-hills and sand-cliffs, etc. Not uncommon. Bearing fruit, though rarely in early spring.

Dioicous; forming whitish, shining tufts; branches few, erect; leaves pointing every way, sulcate, ovate, strongly acuminate, entire, more spreading when moist, nerve reaching above halfway up; fruitstalk even; sporangium ovate, curved, dark brown; lid conical, acute.

This is closely allied to the last, especially in the smaller forms, but its habit is more delicate, the plant more erect, and the leaves, though acuminate, by no means piloso-acuminate. I find them quite entire, but they are sometimes minutely serrulate at the tip.

†† *Leaves even or only slightly striate.*

*a. Fruitstalk rough.*

‡ *Lid conical or acute.*

6. *H. velutinum*, *Dil., L.*; decumbent, irregularly pinnate; branches crowded, often curved at the tips; leaves spreading, subsecund, ovato-lanceolate, acuminate, serrated; nerve reaching halfway; fruitstalk rough; sporangium ovate, cernous; lid conical, not very acute.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1568, 2421.*; (Plate 5, fig. 4); *Moug. & Nest. n. 835.*

On the trunks of trees and occasionally on stones and on the ground. Common. Perfecting its fruit in winter or early spring.

Monoicous; forming flat tufts of a dark green when growing in the shade, but tawny when exposed to the sun. Stem creeping; branches crowded, irregularly pinnate; leaves inclined to be secund, ovato-lanceolate, acuminate, toothed, margin recurved at the very base, nerve not much exceeding the middle of the leaf, cells loose; fruitstalk rough, half an

inch long; sporangium ovate, cernuous, curved when dry; lid conical, rather obtuse; ring large, deciduous.

This common and variable species differs from *H. rutabulum* in its smaller size, more creeping habit, and narrower subsecund leaves. The branches are sometimes very slender, and vary in quantity; the leaves are opaque or shining, and the colour green or inclining to tawny.

7. *H. reflexum*, *Web. & Mohr*; stem procumbent, arched at the end and rooting, irregularly pinnate; branches incurved; leaves erecto-patent, ovate, acuminate, serrated, nerved to the tip, lid conical, acute.—*Hook. & Wils. t. xxiv.*; (*Moug. & Nest. n. 424.*)

In subalpine countries, on the trunks of trees or on stones. Principally in Scotland. Perfecting fruit in late autumn and early spring.

Monoicous. Stem slender, procumbent, arched at the extremity, and rooting, light green, irregularly pinnate, the branches and branchlets curved at the tips; leaves erecto-patent or slightly subsecund, ovate, acuminate, toothed; leaf-cells large, especially at the base; nerve reaching to the tip; fruitstalk rough, half an inch long; sporangium ovato-globose; lid conical, acute.

Allied to the last, but the leaves are in general shorter, though sometimes quite as acuminate and not broader at the base, the nerve almost excurrent, and the tips of the branches and branchlets curved. The sporangia, also, are more globose.

8. *H. rutabulum*, *L.*; stem creeping, branches and branchlets erect, mostly attenuated upwards; leaves spreading, ovate, acuminate, serrate; nerve reaching a little above the middle; fruitstalk rough; sporangium ovate, cernuous; lid conical, blunt, with a little point.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1261, 1647.*; (*Plate 5, fig. 5*); *Moug. & Nest. n. 143.*



On stones, trunks of trees, shady ground, etc. Extremely common. Fruit perfect in winter and early spring.

Monoicous; robust, forming dark green or sometimes yellowish-green tufts. Stem procumbent, irregularly branched; branches erect; leaves erecto-patent, ovate, acuminate, concave, narrowed at the base, serrated through their whole length, slightly striate when dry; nerve slender, reaching more than halfway up; cells loose, especially at the base; perichæatial leaves squarrose, with a long tip; fruitstalk stout, 1 inch long, strongly granulated; sporangium ovate and turgid or ovate-oblong, arcuate, cernuous; lid large, conical, sharp-pointed.

Like most common species, this is very variable, but it is distinguished by its rough fruitstalk, the absence of striæ in the leaves when moist, and by the monoicous inflorescence from *H. salebrosum*, *rivulare*, *cæspitosum*, etc., which could possibly be confounded with it. The stems often become arched and take root at the extremity, and are frequently clothed beneath with short purple-brown rooting hairs.

9. *H. rivulare*, *Bruch, mss.*; stems arched, irregularly branched; branchlets curved; leaves large, loosely set, patent, ovate or ovate-oblong, decurrent at the base, acuminate, serrate; nerve reaching more than halfway; fruitstalk rough; sporangium ovate, incurved, cernuous; lid conical, rather acute.—*Hook. & Wils. t. lv.*; (Plate 5, fig. 6); *Moug. & Nest. n. 1134*

On the borders of streams, on stones and rocks, or in the beds of rivulets from Lancashire to Sussex. Not uncommon in Wales. Perfecting fruit in autumn.

Dioicous; forming bright or yellow-green tufts. Branches at first attenuated; leaves not crowded, patent, ovate or ovate-oblong, acuminate, serrate, with a decurrent base; cells loose, especially at the base; nerve reaching more than halfway up;



erect, arcuate, generally simple; leaves densely imbricated, erecto-patent, ovato-lanceolate, acuminate, slightly serrate; nerve reaching above the middle; fruitstalk even below; sporangium ovate, cernuous; lid conical, very acute.—*Hook. & Wils. t. xxv.*; *Eng. t. 1496, 2071.*; (Plate 5, fig. 3); *Moug. & Nest. n. 520.*

On stones, rocks, and walls in damp, watery places, usually in subalpine districts. Bearing fruit in winter and spring.

Monoicous; forming dense bright, or occasionally yellow or rufous-green masses. Stems creeping, bearing short, thick, mostly simple branches; leaves concave, ovato-lanceolate, shortly acuminate, generally subsecund, of a dense texture, very slightly serrate; nerve reaching in general far above the middle, sometimes forked near the base; fruitstalk 1 inch high, slightly granulated above only, even below; sporangium ovate or subglobose, cernuous; lid very acute.

The broader leaves, of a dense texture and far less acuminate, \* added to the large sporangium, distinguish this from the last. The subaquatic habit must also be taken into account. The leaves on the young branchlets, represented on our plate, from a Braemar specimen, are thinner, and more decidedly serrate, with a shorter nerve. Schimper says of the nerve, “vix ultra medium producta.” Sometimes the leaves are slightly striate.

γ. SCLEROPODIUM, *Schimp.\**

12. *H. cæspitosum*, *Wils.*; stem creeping, with short, simple, curved branches; leaves ovate, concave, spreading, minutely toothed; nerve reaching above halfway up; sporangium oblong, curved, suberect; lid conical, acute.—*Wils. & Hook. t. lv.*; *Eng. Bot. t. 2878.*

\* This differs from *Brachythecium* in its narrower leaf-cells; from *Hypnum*, *Schimp.*, only in its rough fruitstalk. The Greek word σκληρός, however, does not signify rough in the sense of scabrous.

On walls of red sandstone and roots of trees, especially where subject to inundation. Lancashire and Cheshire, also in Sussex and Yorkshire. Fruiting in winter and early spring.

Dioicous; forming low, dense tufts, with short, simple branches; leaves loosely imbricated, inclined to be secund, ovate or ovato-lanceolate, pointed but not strongly acuminate, minutely serrate; fruitstalk rough; sporangium inclined to be erect, only slightly curved; lid half as long as the sporangium.

Of this I have seen no specimen. It has been found on the Continent by Spruce, in the Pyrenees. It is distinguished from *H. rutabulum* by its longer lid and less acuminate, more spreading, shining leaves, besides other points.

13. *H. illecebrum*, *Schwæg.*; stem procumbent, slightly pinnate; branches short, incurved; leaves crowded, erecto-patent, ovate, concave with a reflexed point, minutely serrated; nerve strong, ending below the tip; fruitstalk rough; lid conical, obtuse, with a little terminal point.—*Wils. & Hook. t. xxxv.*; *Eng. Bot. t. 2715.*; (*Moug. & Nest. n. 1219.*)

On grassy banks and rocky pasture-ground near the sea; at present not found north of Holyhead. Bearing fruit in autumn and early winter.

Dioicous; pale green; stem procumbent, sparingly pinnate, tomentose beneath; branchlets short, erect, thin, incurved, obtuse; leaves closely imbricated, very concave, erecto-patent, ovate with a recurved point, minutely serrated, especially above, shining; nerve strong, vanishing below the tip, often forked, sometimes projecting from the back of the leaf "like the awn of a grass;" fruitstalk scabrous; sporangium elliptic-oblong, cernuous; lid conical, obtuse, with a little terminal point; perichaetial leaves with the nerve reaching scarcely halfway up.

This appears to be a southern Moss, and though scarcely more than an inch high in British specimens, attaining, in the south of Europe, a much larger size. It resembles somewhat *Hypnum purum* in its pale, inflated leaves, but differs notably in its rough fruitstalk. I find the leaves exactly as represented in Sowerby's figure, and not bristle-tipped. Occasionally they are striate, and the margin slightly reflexed, in Wilson's Welsh specimens.

‡‡ *Lid rostrate.*

δ. EURHYNCHIUM, *Schimp.\**

14. **H. crassinervium**, *Tayl.*; stem creeping; branches short, erect, simple; leaves spreading, ovate, concave, with a broadly reflected margin, suddenly acuminate, minutely serrate; nerve strong below, reaching more than halfway; fruitstalk rough; sporangium ovate, cernuous; lid rostrate.—*Hook. & Wils. t. lv.*; *Eng. Bot. t. 2706.*; (*Moug. & Nest. n. 1227.*)

On limestone rocks in shady places. South of Ireland, Wales, and Yorkshire. Found also in southern Europe. Bearing fruit in early spring.

Dioicous; forming flat, silky, emerald-green tufts. Stem procumbent, with erect, simple, sometimes fasciculate, short branches; leaves glossy when dry, imbricated, pointing every way, patent, very concave with a broad reflexed margin, ovate, suddenly acuminate, the tip sometimes recurved, minutely serrate, especially above; nerve reaching scarcely more than halfway, strong below, much attenuated above; cells narrow; fruitstalk very rough; sporangium ovate, cernuous, scarcely arcuate; lid with a long, slender beak.

\* Distinguished from *Brachythecium*, as the name implies, by the beaked lid; and from *Rhyncostegium* by the looser reticulations, in which the primordial cell is distinctly visible.

A fine species, distinguished from *H. rutabulum* not only by the beak, but by the reflected margin of the leaves, and more suddenly acuminate tip.

15. *H. piliferum*, *Schreb.*; stem procumbent, slightly branched, more or less regularly pinnato-ramulose; branches attenuated; leaves erecto-patent, ovate, with an abrupt hair-like tip, entire; nerve reaching halfway; fruitstalk rough; sporangium ovate-oblong, cernuous; lid awl-shaped.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1516.*; (*Moug. & Nest. n. 624.*)

Shady banks and woods or on stones. Local; often abundant where it occurs at all. Bearing fruit, but rarely, in late winter and early spring.

Dioicous; forming loose, depressed, shining-green or when exposed to the sun yellowish tufts, often several inches long, especially when barren; stem irregularly divided, the branches more or less pinnate; leaves loosely imbricated, ovate or on the branchlets ovate-oblong, very concave, decurrent, entire or only obscurely serrulate, with a sudden, long, hair-like point; margin not reflected; nerve reaching halfway up, faint above; cells narrow; fruitstalk an inch and a half long, scabrous; sporangium ovate or ovate-oblong, often curved, cernuous; lid large, as long as the sporangium, with a subulate, curved beak.

16. *H. speciosum*, *Brid.*; stem creeping; branches simple, erect; leaves loosely set, patent, ovate, acute, serrated; nerve reaching almost to the tip; fruitstalk rough; sporangium ovate, tapering at the base, cernuous; lid rostrate.—*Hook. & Wils. t. lv.*

On stones, near springs and in watery places. Anglesea and Sussex. Bearing fruit in December.

Male and female flowers growing together; forming low, often floating tufts. Stems creeping, giving off erect, simple

branches, with loosely set, ovate, acute, serrated leaves, of a bright shining green, acute rather than acuminate (in Sussex specimens); cells broader than in the two preceding species; fruitstalk scabrous; sporangium obovate or ovate-oblong, ecrnuous; lid rostrate, shorter than the sporangium.

This species has not at present been found on the Continent.

16\*. *H. cirrhosum*, Schwæg.; stem erect or procumbent, sparingly branched; branches erect, cylindrical; leaves imbricated, elliptic-oblong, concave, shining, ending in a long, hair-like, serrated point; cells rhomboid, broader at the base; nerve simple or forked.

Top of Ben Lawers, Dr. Arnott. Not yet found in fruit. Supposed by Schimper to be a *Brachythecium*. Possibly, according to Wilson, a variety of *H. piliferum*. Its immediate affinities, however, must be doubtful, in the absence of fruit.

*chun*. 17. *H. prælongum*, L.; stem prostrate, elongated, loosely branched or subpinnate; branches short, acute; leaves loosely set, cordate, acuminate, serrated; nerve reaching more than halfway up; fruitstalk rough; sporangium oblique; lid strongly rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 2035*, 2942, f. 3. (*Moug. & Nest. n. 422.*)

On the ground, on decayed wood, &c. Common. Fruit matured in winter.

Dioicous; forming flat patches, with long, arched, or prostrate stems, sometimes loosely branched, sometimes irregularly bipinnate; branches short, more or less acute; leaves not crowded, squarrose, cordate, acuminate, strongly serrate; nerve reaching far above the centre; cells narrow; fruitstalk about half an inch high, rough; sporangium ovate-oblong, set on obliquely, ecrnuous; lid with a very long, acute beak.

A very variable species, differing occasionally greatly in

habit. *H. Stokesii*, originally observed in Ireland, but widely dispersed over Europe, which is still considered distinct by Schimper, has wider, more decurrent leaves, with numerous more or less lanceolate, serrate, finely-nerved paraphylla; but though certainly remarkable for its more erect densely caespitose habit, does not appear to be truly distinct.—*Hook. & Wils. t. lv.*; *Eng. Bot. t. 2036.*; (*Moug. & Nest. n. 1029.*)

*Hypnum Swartzii*, Turn. (*Hook & Wils. t. lv.*; *Eng. Bot. t. 2034*), has broadly ovate or cordate, acute, not acuminate leaves, seated loosely on short obtuse branches, and less flaccid when dry. The stem moreover is not pinnate, and the sporangium is said to be less oblique. The last character however appears to be very doubtful, the degree of inclination varying in undoubted specimens of *H. prælongum*. I believe that Bridel is quite right in considering it a mere variety.

18. *H. pumilum*, *Wils.*; stem creeping or procumbent, filiform, subpinnate; branches very slender, rather flattened; leaves very small, ovate, spreading, serrulate; nerve reaching halfway; fruitstalk rough; sporangium roundish, ovate, cernuous; lid with a short beak.—*Hook. & Wils. t. lv.*; *Eng. Bot. t. 2942, f. 1.* 2071.

On hedgebanks, sandstone rocks, etc. Bearing fruit from November to spring.

Dioicous; extremely delicate, creeping, with a few subpinnate branches; leaves distant, lanceolate, slightly serrate, not decurrent, nerved halfway up; sporangium minute, on a short, rough stalk, cernuous; perichæatial leaves small; lid with a short acute beak.

This delicate species has the habit of *H. serpens*. It has been found in several places in England, and occurs here and there on the Continent.



ε. RHYNCOSTEGIUM, *Schimp.*

19. *H. Teesdalii*, *Sm.*; stem creeping, filiform, slightly branched; branches short; leaves loosely set, lanceolate, obscurely serrate; nerve reaching almost to the tip or excurrent; fruitstalk rough; sporangium ovate, cernuous; lid rostrate.—*Hook. & Wils. t. 1v.*; *Eng. Bot. t. 202, t. 2942, f. 2.*

On trunks of trees and rocks, especially near waterfalls. Bearing fruit in spring and early summer.

Monoicous; forming velvety dark-green patches with creeping stems, from which spring short, thread-shaped branches; leaves loosely set, rigid, spreading, often two-ranked, lanceolate, with a thick nerve, which reaches nearly to the tip, or extends beyond it; perichætical leaves scarcely covering the vaginula; fruitstalk not half an inch long, rough; sporangium ovate, cernuous, with a rostrate lid nearly as long.

A much more rigid plant than the last. It is found as far south as Teneriffe, and extends as far north as Scotland.

*b. Fruitstalk even.*

+ *Lid rostrate.*

δ. EURHYNCHIUM, *Schimp.*

20. *H. myosuroides*, *L.*; stem creeping, bearing many dendroid branches; branches and branchlets curved, secund; leaves ovato-acuminate, slightly serrated; nerve reaching more than halfway up; perichætical leaves squarrose; fruitstalk even; sporangium inclined, rarely erect; lid rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1567.* (*Moug. & Nest. n. 330.*)

On stones, rocks, and trunks of trees. Common. Maturing the fruit in winter.

Dioicous; forming large, soft, pale-green tufts; stems creeping, bearing erect, tree-like or fasciculate branches; leaves spreading, ovato-lanceolate, acuminate, slightly serrate;

nerve reaching more than halfway up ; fruitstalk even ; sporangium elliptic, oblong, somewhat cernuous, rarely erect or symmetrical ; lid rostrate, about half as long.

This species is placed by Wilson and others in *Isothecium*, but the sporangium is by no means constantly symmetrical, and the inner peristome has intermediate teeth, as in true *Hypna*. I think, therefore, that Schimper is quite justified in placing it in *Eurhynchium*. He says that it prefers sandy and granite formations ; but it certainly is by no means confined to them in England. Its close resemblance to *Isothecium myurum* has mainly contributed to its being placed in the same genus.

21. *H. strigosum*, *Hoffm.* ; stem creeping or decumbent, subpinnate ; branches suberect, attenuated ; leaves crowded, imbricated, spreading, widely cordato-ovate, concave, rather obtuse, serrated ; nerve reaching above halfway ; sporangium ovate, cernuous ; lid rostrate.—*Hook. & Wils. t. lv.*

On the roots of trees, banks, and dry rocks. Said to have been found in Cornwall by Mr. Tozer. Bearing fruit in autumn.

Pseudomonocous ; the male gemmæ, derived from another plant, adhering by radicles to the female plant ; forming loose, flat, or swollen, dense tufts ; stem creeping ; branches pinnate, erect, or prostrate, attenuated or flagelliform ; leaves broad at the base, acute but scarcely acuminate, sharply serrated ; paraphylla numerous, roundish, or ovate ; fruitstalk even ; sporangium cernuous, subhorizontal.

22. *H. circinatum*, *Brid.* ; stem suberect, areuate, subpinnate ; branches subfasciculate, curved and drooping ; leaves narrowly ovato-acuminate, crowded, subsecund ; nerve reaching almost to the tip ; fruitstalk even ; sporangium ovate, cernuous, curved ; lid rostrate.—*Hook. & Wils. t. lv.*

On shady limestone rocks and walls, near the sea. In the west of England. Wales; from Anglesea southward. Bearing fruit, though very rarely, in spring.

Dioicous; forming more or less dense tufts of a deep green. Stem creeping, bearing slender, erect, arched branches, which are themselves branched above; the branchlets curved or curled; leaves crowded, ovato-lanceolate, with a slender nerve reaching almost to the tip, minutely serrate; fruitstalk even, twisted in different directions above and below; sporangium ovate, with a long beaked lid.

Differing from the last in its circinate branchlets; ovato-lanceolate leaves, with a thicker, longer nerve, shorter cells, and the inner perichætical leaves being strongly nerved.

23. *H. striatulum*, *Spruce*; stem creeping, densely tufted; branches crowded, erect; leaves erecto-patent, ovate, acuminate, somewhat striated, serrate; nerve reaching above half-way; fruitstalk even; sporangium oblong, cernuous; lid rostrate.—*Hook. & Wils. t. lv.*

On calcareous rocks, walls, and mounds, and at the roots of trees. First discovered by Spruce in the Pyrenees, and found since in Ireland, Somersetshire, and Sussex. Fruit ripe from December to early spring.

Dioicous; forming loose wide tufts. Stems creeping; branches erect, with fasciculate branchlets; leaves spreading, ovato-lanceolate, acuminate, minutely serrate, nerve reaching beyond the middle, somewhat striate; cells very narrow; fruitstalk even, half an inch long; sporangium oblong, cernuous, with a long lid.

Not half the size of the following, but larger than *H. circinatum*.

24. *H. striatum*, *Hedw.*; stem prostrate or arched, irregularly divided, throwing out fascicles of roots, densely imbricated.

cated, with erect, attenuated, often drooping branches; leaves squarrose, cordate, strongly acuminate, striated, sharply toothed; nerve reaching nearly to the tip; fruitstalk long, even; sporangium oblong, arched, lid rostrate.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1648.*; (*Moug. & Nest. n. 142.*)

On the ground, in woods and orchards. Common. Bearing fruit in autumn and early spring.

Pseudomonocous. Stem partly prostrate, arched or ascending, densely clothed with leaves, and sending down fascicles of rootlets, irregularly branched; branches erect, often dendroid; branchlets often two-ranked, attenuated at the extremities, curved; leaves widely spreading, or squarrose, broadly cordate, suddenly acuminate, strongly toothed, with a thick nerve reaching nearly to the summit, striated below; cells of the upper part of the leaves extremely narrow with the exception of the marginal cells which form the serratures; perichæcial leaves squarrose, nerveless; vaginula hairy; fruitstalk an inch long, even; sporangium oblong, subcylindrical, curved, cernuous; lid with a long, curved, slender, acute beak.

A fine though common species, easily known from *H. rotabulum* by its rostrate lid, very acuminate, strongly striated leaves, and smooth stem.

#### ε. RHYNCOSTEGIUM, *Schimp.*

25. *H. ruscifolium*, *Neck.*; stem creeping, irregularly branched; branchlets erect, arched; leaves spreading, ovate, pointed, subsecund, rather rigid, serrate; nerve reaching more than halfway up; fruitstalk even; sporangium ovate, slightly curved, cernuous; lid rostrate.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1275.*; (Plate 6, fig. 1); *Moug. & Nest. n. 427.*

On stones in rivulets, sluices, etc. Very common. Bearing fruit in winter and early spring.

Monoicous; forming dense tufts of a deep dull green, often spreading out into the water. Stem creeping, generally naked below, irregularly branched; branchlets erect, often arched; leaves imbricated, rather rigid, oval, acute, broad at the base, often slightly flattened so as to be subsecund, serrate; nerve reaching far above the middle; fruitstalk even; sporangium firm ovate, cernuous; lid rostrate, acute, two-thirds as long as the sporangium.

Schimper describes the leaves as decurrent at the base, but I find them as described by Wilson. It varies much, according to the locality, and sometimes has very concave leaves, which are not at all distichous.

26. *H. murale*, Neck.; stem creeping, irregularly branched; branchlets crowded, erect, obtuse; leaves concave, subelliptic, with a short, abrupt point, entire or finely serrate; nerve reaching above halfway; fruitstalk even; sporangium ovate; lid rostrate.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1038.*; (Plate 6, fig. 2); *Moug. & Nest. n. 145.*

On rocks and stones, especially those which are calcareous. Not uncommon. Fruiting in winter and early spring.

Monoicous; forming pale-green patches, or sometimes tinged with red; stem creeping, loosely branched, with numerous shining, crowded, cylindrical, often obtuse branchlets; leaves densely imbricated, or rather distant, concave, elliptic, shortly mucronate, nearly or quite entire; nerve reaching more than halfway up; fruitstalk even, half an inch high; sporangium ovate, cernuous; lid with a long beak.

The leaves vary, in different forms, in being more or less concave, and having a more or less decided point; they are never however acuminate as in the next species.

27. *H. confertum*, Dicks.; stem creeping; branches sub-pinnate; branchlets erect; leaves erecto-patent or complanate,

ovate, acuminate, serrulate; nerve reaching more than half-way; fruitstalk even; sporangium oval, cernuous; lid acutely rostrate.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 2407.*; (*Moug. & Nest. n. 1316.*)

On stones, shady walls, trunks of trees, etc. Not uncommon. Bearing fruit in winter and early spring.

Monoicous; forming short, flattish, bright green patches; stem creeping, slightly divided; the branches more or less pinnate; leaves spreading or flattened, and somewhat secund, ovate, acuminate, slightly serrate, nerve reaching more than halfway; fruitstalk even, not half an inch high; sporangium small, ovate, cernuous; lid with a slender awl-shaped beak as long as the sporangium.

*Eng. Bot. t. 2553* and *t. 1262* represent the complanate state of the plant which has occurred both in England and Scotland.

28. *H. megapolitanum*, *Bland.*; stem creeping; branchlets irregularly branched; leaves broadly ovate, acuminate, more or less serrate, nerve reaching more than halfway; fruitstalk even; sporangium oblong, curved, cernuous; lid rostrate.—*Hook. & Wils. p. 356*, under *H. confertum*.

On sandy banks. Sussex. Mr. Mitten. Bearing fruit in spring.

The loose, straggling, stouter habit, much larger size, more broadly ovate leaves, almost cordate at the base but more acuminate above, and oblong sporangium, seem to justify Schimper in keeping this species distinct, of which, however, I have seen no specimens. The areolation of the leaves is also said to be looser.

29. *H. depressum*, *Bruch*; stem prostrate, much depressed; branches pinnate; leaves bifarious, ovate or ovato-oblong, slightly serrate, two-nerved at the base; fruitstalk even;

sporangium ovate-oblong, cernuous; lid rostrate.—*Hook. & Wils. t. lix.*

On calcareous rocks and stones. From Scotland to Anglesea. Ripening fruit, on the Continent, in spring.

Dioicous; forming very flat, soft, emerald-green or sometimes yellowish patches. Stem repeatedly divided; branches more or less pinnate; leaves flattened, crowded, ovate or ovate-oblong, with two short nerves at the base, pointed but scarcely acuminate, slightly serrate; fruitstalk even, half an inch long; sporangium ovate-oblong, slightly curved, cernuous; lid rostrate, shorter than the sporangium.

This species, which is intermediate between *H. confertum* and the next, is readily distinguished by its much flattened branchlets and different nervation. It has not been found in fruit in this country.

30. *H. demissum*, *Wils.*; stem prostrate; slightly and irregularly branched; leaves somewhat flattened, subseund above, ovato-lanceolate, narrowed at the base, entire, nerveless, or with two faint nerves; margin recurved; fruitstalk even, very slender; sporangium elliptic-oblong, cernuous; lid with a very slender long beak.—*Hook. & Wils. t. lix.*; *Eng. Bot. t. 2740.*; (Plate 11, fig. 6); *Moug. & Nest. n. 1315.*

On quartzose rocks. Killarney and Beddgelert. Bearing fruit in summer and winter.

Monoicous; forming flat, bright, shining, yellow patches; stems prostrate, more or less divided, scarcely interwoven; branches few, short; leaves spreading below, rather seund above, oblong or elliptico-lanceolate, narrow and somewhat eared at the very base; nerveless or with two faint nerves; entire, slightly reflexed; fruitstalk one-third of an inch high, even, very slender; sporangium oblongo-elliptic, small, cernuous, sometimes symmetrical; lid with a very long slender beak.

This Moss occurs in North America with other allied species, but is very rare in Europe.

31. *H. tenellum*, *Dicks.*; stem creeping; branches and branchlets erect, crowded; leaves erecto-patent, narrow, lanceolate, entire; nerve reaching nearly to the tip; fruitstalk even; sporangium ovate; lid rostrate.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1859.*; (*Moug. & Nest. n. 233.*)

On walls and rocks, especially those which are calcareous. Common. Bearing fruit in early spring.

Monoicous; forming silky emerald-green or yellowish tufts. Stem creeping, with erect, crowded branches or branchlets; leaves crowded, very narrow, lanceolate, almost filiform above, entire; nerve rather faint, reaching nearly to the tip; fruitstalk even, a quarter of an inch long; sporangium ovate, cernuous; lid as long as the sporangium.

A small, delicate species, easily distinguished from *H. Teesdalii* by its even fruitstalk, less prominent nerve, and lighter leaves.

++ *Lid conical.*

ζ. AMBLYSTEGIUM, *Schimp.\**

32. *H. serpens*, *L.*; stem creeping, rooting; branchlets erect, short, crowded, thread-shaped; leaves spreading or subsecund, ovato-lanceolate, acuminate, entire; nerve faint, reaching halfway up or nearly to the tip; fruitstalk even; sporangium oblong, curved, cernuous; lid conical, acute.—*Hook. & Wils. t. lxxiv.*; *Eng. Bot. t. 1037.*; (*Moug. & Nest. n. 332.*)

On walls, moist banks, trunks of trees, etc. Bearing fruit in spring and summer. Very common.

Monoicous; forming thin, yellow-green patches; stem

\* Differing from *Hypnum*, *Schimp.*, only in the looser texture of the leaves.



creeping, rooting through its whole length, more or less branched, the branches erect or suberect, slender, sometimes slightly pinnate; leaves spreading below, sometimes inclined to be secund above, entire, ovato-lanceolate, very acuminate, translucent; nerve reaching to the apex or not more than half-way; cells rather broad, angular; fruitstalk even; sporangium oblong, curved or obovate; lid conical, acute.

A very common species, and therefore very variable as regards habit, the shape of the leaves, nervation, length of the footstalk, and form of the sporangium. The small size at once distinguishes it from its nearest allies, as does the conical lid from *H. Teesdalii* and *tenellum*.

33. *H. radicale*, *Pal. Beauv.*; monoicous; stem creeping, irregularly branched; branches rigid, suberect; leaves more or less spreading, cordato-ovate or ovato-lanceolate, from a cordate or deltoid base, acuminate; nerve vanishing near the apex; perichæatial leaves larger, wider, membranous, serrated, the nerve vanishing below the apex; fruitstalk very long; sporangium arcuate, oblong, cernuous; lid conical, shortly and sharply rostellate.—*Hook. & Wils. t. xxvi.*

On moist ground, amongst grass. Anglesea and South Wales. Bearing fruit in spring. A rare species.

The above is copied from Wilson's description, as I have seen no specimen. It occurs abundantly in North America. Rather more robust than the last, with larger and firmer leaves of a denser texture, wider and more cordate below; the nerve also is more prominent.

34. *H. irriguum*, *Hook. & Wils.*; monoicous; stem rigid; branches pinnate; leaves secund, deltoideo-ovate, acuminate, slightly serrated, strongly nerved; sporangium oblong, curved, cernuous, strongly arcuate and contracted below the mouth when dry; annulus subpersistent; lid conical.—*Hook. & Wils.*

*t.* xxv. ; (*Moug. & Nest. n.* 625 ; a barren specimen mixed with the next.)

On stones in rivulets, by mill-dams, etc. From Yorkshire to Sussex. Bearing fruit in spring.

Of this, like the last, I have seen no fertile specimen. It is clearly allied to *H. serpens*, especially to the stronger-nerved form, but is distinguished by the larger size and opaque areolation. From the next it differs in being far more rigid, the pinnate branches, closer areolation, more slender nerve, shorter sporangium, broader leaves, which are deltoid at the base, and less acute lid.

35. *H. fluviatile*, *Swartz* ; stem prostrate, ascending above with more or less depressed branchlets ; leaves rather loosely set, erecto-patent, concave, ovato-lanceolate, acute, entire, with a very strong nerve ; fruitstalk even ; sporangium cylindrical, curved ; lid conical, acute.—*Hook. & Wils. t.* lv. ; (*Moug. & Nest. n.* 625, with a barren specimen of the last in my copy.)

On stones in rivulets. Scotland and Wales. Bearing fruit in May and June.

Monoicous ; forming large dark-green or reddish tufts. Stem prostrate, slightly branched, naked below with a few radicles ; the branches and remote branchlets suberect, drooping or prostrate ; leaves loosely imbricated, incurved when dry, ovato-lanceolate, acute, concave, quite entire, with a very strong reddish nerve, which reaches almost or quite to the tip, and is often dilated above ; margin slightly recurved below ; leaf-cells rather short ; fruitstalk even, an inch long ; sporangium elongated, cylindrical, curved, especially when dry ; lid conical, with a sharp point.

36. *H. riparium*, *L.* ; stem prostrate, free above, irregularly and remotely branched ; leaves loosely set, spreading, ovato-

lanecolate, entire; nerve reaching more than halfway; sporangium oblong, curved, eernuous; lid conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 2060.*; (Plate 6, fig. 3.)

On the banks of ponds, or on stones occasionally flooded; sometimes more strictly aquatic. Common. Bearing fruit in summer.

Monoicous; forming loose, soft, green or yellowish tufts. Stem creeping, flaccid, irregularly divided, rarely subpinnate; branches procumbent or suberect; leaves generally complanate, crowded or distant, rarely subsecund, ovato-lanceolate, acute, entire, slightly decurrent at the base; nerve reaching beyond the middle; cells narrow; fruitstalk even, about an inch high; sporangium oblong, subcylindrical, curved; lid conical, acute.

Extremely variable, resembling sometimes *H. fluitans* and other aquatic species; *Moug. & Nest. n. 1134* (at least in my copy) is some short-fruited rough-stalked Moss, with ovate, serrated leaves, and apparently *H. rutabulum*. When growing in the water, it assumes sometimes the habit of *Fontinalis*. *Moug. & Nest. n. 1034* is apparently a state of *H. aduncum*.

η. HYPNUM, *Schimp.*

37. *H. elodes*, *Spruce*; stem slender, elongated, procumbent, subpinnate; branches slender, acute, curved at the tips; leaves loose, patent, subsecund above, lanceolate, acuminate, entire; nerve reaching almost to the tip; fruitstalk even; sporangium cylindrical, curved; lid conical.—*Hook. & Wils. t. lvi.*

In bogs and marshes, on the ground or on the root of trees. Bearing fruit in spring. From Liverpool to Anglesea.

Dioicous; delicate; yellow or reddish-green. Stem slender, procumbent, slightly pinnate; branches procumbent or erect; leaves distant, spreading, lanceolate, much elongated, the younger curved and almost falcate, nearly entire; nerve

strong, reaching to or nearly to the tip; cells narrow, except at the slightly reflexed base; fruitstalk even,  $1\frac{1}{2}$  inch high; sporangium subcylindrical, curved, cernuous; lid conical, acute.

In the figure in 'Bryologia Britannica' the leaves are represented as strongly serrated above, which neither accords with the description nor with Spruce's specimens. Even below, the serratures are very obscure.

\*\* *Leaves acute, mostly squarrose, shortly nerved or nerveless (occasionally in certain leaves, as in H. chrysophyllum, there is a longer nerve; in H. polygamum there is a long nerve).*

38. **H. Halleri**, *L. jun.*; stem creeping, pinnate; branches short, erect; leaves closely imbricated, spreading, squarrose, broadly ovate, acuminate, serrated, obscurely two-nerved at the base; fruitstalk even; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. xxxv.*; *Grev. Sc. Crypt. Fl. t. 174.*; (*Moug. & Nest. n. 626.*)

On alpine rocks, as Ben Lawers; said also to be found in Herefordshire. Bearing fruit from autumn to spring.

Monoicous; forming circular patches, which are said to be of a glaucous hue when growing but of a golden-brown when dry, pinnate; the branches erect, short, and nearly level; leaves densely imbricated, their tips recurved, broadly ovate at the base, acuminate above, serrated, with two short obscure nerves or sometimes nerveless; margin reflexed at the base; cells narrow, but not vermiform; fruitstalk even, about half an inch high; sporangium cylindrical, curved, cernuous; lid conical, with a central rather obtuse tip.

A small but very pretty species, allied to *H. polymorphum*, but at once distinguished by the strongly recurved leaves.

39. **H. polymorphum**, *Hedw.*; stem procumbent, scarcely

pinnate; branches simple, erect, slender; leaves crowded, spreading, subsquarrose, subsecund, ovato-lanceolate, acuminate, entire, nerveless; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Eng. Bot. t. 1709.*; (*Moug. & Nest. n. 1032.*)

On walls and banks in limestone districts, from Yorkshire to Wales. Bearing fruit in May.

Monoicous; forming thin yellowish patches. Stems slender, more or less subpinnate; leaves crowded, rather squarrose, ovate with a sudden narrow acuminate tip, nerveless, entire; cells loose; fruitstalk even,  $\frac{1}{3}$  inch high; sporangium minute, oblong, curved, cernuous; lid conical.

A delicate species, smaller than the next, and with leaves not so wide at the base. It is *H. Sommerfelti* of Schimper's 'Synopsis.'

40. *H. chrysophyllum*, *Brid.*; stem prostrate, with distant pinnæ; leaves crowded, subsquarrose, ovate or cordato-ovate, acuminate, entire, mostly nerved more than halfway; sporangium subcylindrical, curved; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 2671.*; (Plate 6, fig. 5); *Moug. & Nest. n. 731.*

In fallow-fields and marsh-lands occasionally from Cheshire to Sussex. Sometimes on walls. Bearing fruit in summer.

Dioicous; forming golden-green patches. Stems creeping or procumbent, distantly branched in a pinnate manner; pinnæ short, suberect; leaves crowded, spreading widely, squarrose, subsecund, ovate or cordate at the base, acuminate, entire, nerveless or more frequently furnished with a nerve reaching about halfway; cells very narrow, not much enlarged, as in the next, at the base; fruitstalk even, an inch or more long; sporangium subcylindrical, curved, cernuous; lid conical, rather acute.

Differs from the next in its prostrate pinnate habit, mostly nerved, less cordate leaves, and absence of loose tissue at the base. The prostrate form, however, of *H. stellatum* comes very near to it.

41. *H. stellatum*, *Schreb.*; stem erect, tufted, loosely branched; branches pointed; leaves squarrose, entire, nerveless, deltoideo- or cordato-ovate, acuminate; cells at the base very loose; fruitstalk even; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1302.*; (Plate 6, fig. 6); *Moug. & Nest. n. 234.*

In boggy ground. Not uncommon. Bearing fruit in summer.

Dioicous; forming loose or dense tufts. Stems 2 or 3 inches high, more or less erect, loosely branched, sometimes subpinnate; branches cuspidate at the tips; leaves crowded, decidedly squarrose, entire, cordato-ovate, acuminate or deltoid at the base, entire, quite nerveless or with two faint yellow lines; cells very narrow, except at the base; fruitstalk even, 1½ inch long; sporangium oblong, curved, cernuous, varying very much in size; lid conical, rather acute.

A much larger plant than the last, and, like that, of a more or less yellow tinge.

42. *H. polygamum*, *Br. & Schimp.*; stem procumbent, more or less pinnate; leaves rather loosely set, spreading, scarcely squarrose, ovate or ovato-lanceolate, acuminate, entire; nerve reaching more than halfway; cells at the base large; fruitstalk even; sporangium oblong, cernuous, or horizontal; lid conical, acute.—*Hook. & Wils. t. lvi.*; (Plate 6, fig. 4.)

In bogs and marshy, often sandy ground, from Dundee to Dublin. Bearing fruit in summer.

Polygamous, bearing female or bisexual flowers clustered at

the base of the periehætical branches; forming tawny patches. Leaves not much crowded, spreading, only slightly squarrose, ovate or ovato-lanceolate, acuminate, far narrower below than the last, but with similar reticulation, entire; nerve reaching far above the middle; fruitstalk even, an inch or more long; sporangium oblong, eurved, subhorizontal; lid acuminate.

Similar in many respects to the last, but with narrow, less squarrose leaves, and a well-marked nerve.

There is, however, a smaller variety, with shorter and more squarrose leaves.

\*\*\* *Leaves roundish, rather obtuse, entire, mostly two-nerved or nerveless.*

43. *H. palustre*, *L.*; stem creeping, more or less branched; branches and branchlets suberect or depressed; leaves crowded, more or less secund, spreading, elliptic, concave, entire, with one short nerve; fruitstalk even; sporangium ovate, cernuous; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1303, 1665, 2406.*; (Plate 7, fig. 1); *Moug. & Nest. n. 521.*

On stones, in rivulets in subalpine countries. Not uncommon. Bearing fruit in summer.

Monoicous; forming broad tufts of a dingy or tawny green. Stem creeping, naked below, irregularly branched; branches and branchlets ascending or depressed; leaves crowded, often secund, more or less spreading, very concave, entire, ovate, rather abruptly attenuated above, with a nerve which scarcely reaches to the middle, sometimes forked above; areolation narrow, with a few larger cells at the base; fruitstalk half an inch long, even; sporangium ovate, curved, cernuous; lid conical, pointed.

A very variable species. The above description applies to the more normal form, but the leaves are sometimes nerveless,

sometimes two-nerved, while occasionally the nerve is very long; sometimes they are not in the least secund, while on the other hand they are occasionally almost falcate. It also varies extremely in size and thickness. The leaves are apparently always very concave, and, as Wilson says, cannot be compressed without splitting.

44. *H. molle*, *Dicks.*; stem procumbent; branches simple, erect or procumbent, rather obtuse; leaves widely spreading, subsecund above, very concave, roundish, apiculate, flaccid, slightly toothed, distinctly two-nerved halfway; sporangium ovate, cernuous, lid conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1992*; *Grev. Sc. Crypt. Fl. t. 283.*; (Plate 7, fig. 2); *Moug. & Nest. n. 730.*

On stones and rocks in mountain rivulets, Scotland. Bearing fruit in summer.

Monoicous; forming pale, reddish, or more frequently lurid, dark-green patches. Stem prostrate, naked below; branches erect, or more or less procumbent, flaccid, cylindrical, obtuse; leaves densely imbricated, spreading below, mostly subsecund above, very concave, roundish with generally an abrupt pointed apex, but sometimes merely shortly acuminate; fruitstalk even, entire, two-nerved, scarcely an inch long; sporangium ovate, curved, cernuous; lid conical, rather obtuse.

A larger, stouter species than the last, from which it is distinguished by its broader, more spreading leaves. Schimper believes that *Hypnum alpestre*, Swartz, is included by Wilson, but that species, which differs mainly in its more rigid, narrower, and less spreading leaves, looser cells, and longer sporangia, does not appear to have been found in this country. A figure of the leaves is given by Wilson, showing the reflexed tips very accurately.

45. *H. arcticum*, *Somm.*; stem creeping; irregularly



branched; branches erect or procumbent, simple, obtuse; leaves spreading, roundish, blunt or shortly apiculate, entire; nerve strong, reaching halfway up, composed of two combined nerves, which are sometimes distinct; fruitstalk even; sporangium ovate, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Grev. Sc. Crypt. Fl. t. 282.*; (Plate 7, fig. 3.)

On stones and rocks in rivulets in Scotland. Bearing fruit in summer.

Monoicous; forming loose olive-green or blackish-green patches, sometimes tinged with red. Stem rigid, procumbent, irregularly branched; branches simple, elongated, generally obtuse; leaves spreading, but scarcely ever squarrose or secund, rigid, roundish, minutely apiculate or obtuse, with a strong nerve reaching halfway up, generally quite entire, but occasionally the margin is slightly irregular; cells narrow, rather shorter than in some neighbouring species; fruitstalk even; sporangium oval or ovate, curved, slightly cernuous; lid conical, obtuse.

More rigid than the last, with longer branches, smaller shorter leaves, and a different nerve.

46. *H. stramineum*, *Dicks.*; stem erect, branched irregularly; branches erect, elongated; leaves imbricated, erectopatient, oblong, obtuse, concave, entire, with a long nerve; fruitstalk even; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Eng. Bot. t. 2405.*; (Plate 7, fig. 4); *Moug. & Nest. n. 516*, with the next.

In bogs amongst *Sphagnum*, occasionally in various parts of Great Britain and Ireland. Bearing fruit but rarely in early summer.

Dioicous; forming erect straw-coloured tufts. Stem erect, thread-shaped, irregularly branched, with a few short branchlets; branches elongated; leaves imbricated, slightly spread-

ing, suberect, oblong or oblongo-ovate, obtuse, entire; nerve reaching nearly to the apex; reticulations at amplexicaul base loose; perichætical leaves much longer; fruitstalk even, an inch long; sporangium oblong, curved, cernuous; lid conical.

Much slenderer than the next, and of a different colour, and very different appearance. Occasionally the stem is less erect than in the normal form.

47. *H. trifarium*, *Web. & Mohr*; stem erect or procumbent, irregularly and slightly branched; branches elongated; leaves densely imbricated, roundish, obtuse, very concave; nerve reaching more than halfway, entire; sporangium ovato-oblong, cernuous; lid conical.—*Hook. & Wils. t. xxxiv.*; *Grev. Sc. Crypt. Fl. t. 279.*; (Plate 7, fig. 5); *Moug. & Nest. n. 516.*

In bogs and rills, principally in the water, occasionally found as far south as Whittlesea Mere, Huntingdonshire, which is now drained. Bearing fruit in summer, but always barren in this country.

Dioicous; forming erect or procumbent chocolate-brown patches. Stem slender, slightly and irregularly branched, the branches following the same direction; leaves imbricated, often obviously trifarious, the axis being spirally twisted, roundish, obtuse, very concave, entire, with a nerve reaching above the middle; cells not much dilated at base; fruitstalk even; sporangium ovato-oblong, curved, cernuous, springing from a distinct neck or apophysis; lid conical.

Very brittle when dry and with a very peculiar habit.

48. *H. sarmentosum*, *Wahl.*; stem prostrate below, ascending above, subpinnate; branchlets short, acute; leaves spreading, elliptic or oblong, obtuse or shortly apiculate, entire; nerve reaching more than halfway up; fruitstalk even; sporangium ovato-oblong; lid conical.—*Hook. & Wils. t. lvi.*

On wet alpine rocks. Scotland, Ireland, and Wales. Bearing fruit, but very rarely, in summer.

Dioicous; forming reddish or purple patches. Stems procumbent, ascending above or sometimes erect, branched in an irregularly pinnate manner; leaves oblong or ovato-oblong, obtuse or apiculate, slightly striated, the tip often cuculliform, entire; nerve red, reaching nearly to the tip; cells at the angles open; sporangium ovato-oblong or subcylindrical, slightly curved, cernuous; lid conical.

Very different in habit from *H. stramineum*, to which it approaches in character, though externally more nearly resembling *H. cordifolium*. The young leaves only are green.

49. *H. cordifolium*, *Hedw.*; stem suberect, elongated, irregularly divided; leaves distant, cordato-ovate or ovato-oblong, entire, blunt, decurrent; nerve reaching above halfway; fruitstalk even; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Eng. Bot. t. 1447.*; (Plate 7, fig. 6); *Moug. & Nest. n. 518.*

In marshes and ditches. Common. Bearing fruit in early summer.

Monoicous; the male flowers situated near the female; forming loose, green tufts some inches long. Stem more or less pinnate; branches short, often cuspidate; leaves spreading, almost squarrose, cordate at the base or ovate, slightly attenuated above or blunt, but always obtuse, entire, concave; nerve reaching nearly to the tip, large; cells at base dilated; fruitstalk even, mostly elongated; sporangium oblong, horizontally cernuous; lid conical.

Differs from *H. stramineum* in the stouter habit and spreading, loosely set, more or less cordate leaves. The base of the tufts is generally dark-brown. The reticulation in this is looser than in most neighbouring species, and resembles

that of Schimper's genus *Amblystegium*. The sinuated primordial sac of which he speaks is visible principally in the dilated rhomboidal cells at the base. I do not see any chlorophyll-grains.

B. *Stem erect, pinnate ; fruitstalks from upper part of stem.*

*Dioicous.*

\* *Leaves nerveless or two-nerved, entire.*

50. **H. cuspidatum**, *L.* ; stem suberect ; branches bifarious, pinnate, cuspidate ; leaves crowded, erecto-patent, ovato-oblong, attenuated, rather obtuse, entire, nerveless ; fruitstalk even ; sporangium oblong, curved, cernuous, tapering below ; lid conical.—*Hook. & Wils. t. xxvi.* ; *Eng. Bot. t. 1425.* ; (Plate 8, fig. 1) ; *Moug. & Nest. n. 227.*

In moist meadows and marshes. Common. Bearing fruit in early summer.

Dioicous ; forming tall, yellowish-green or reddish-brown tufts. Stem rather rigid, erect with a few bifarious pinnate branches, which are cuspidate from the convolution of the upper leaves ; leaves imbricated, erecto-patent, ovato-oblong, attenuated but rather obtuse, concave, nerveless ; reticulation narrow, except at the clasping base ; perichæcial leaves large-celled, deeply plaited, acuminate, with two short nerves according to Schimper ; fruitstalk even, elongated ; sporangium oblong, slightly curved, cernuous, much attenuated at the base, variegated ; lid conical, pointed.

Easily known from neighbouring species by its nerveless leaves.

51. **H. Schreberi**, *Willd.* ; stem rigid, erect, irregularly divided ; branches pinnate ; leaves crowded, imbricated, suberect, ovato-oblong, concave, obtuse, entire, faintly two-nerved at the base ; sporangium ovato-oblong, curved, cernuous ; lid

conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1621.*; (Plate 8, fig. 2); *Moug. & Nest. n. 43.*

On heaths, banks, in woods, moors, etc. Common. Fruit ripe in autumn, but rare.

Dioicous; forming tall, rather rigid tufts of a yellowish-green or tawny. Stem erect, divided irregularly, the branches pinnate, quite devoid of rootlets, sometimes obtuse, but sometimes pointed, drooping and taking root; leaves imbricated, erecto-patent, obtuse, entire, elliptic or ovato-oblong, blunt, shortly two-nerved or with the base merely slightly thickened; margin slightly reflexed at the base; fruitstalk even, an inch or more long, twisted different ways above and below; sporangium small, oblong, curved, cernuous; lid convex.

This beautiful, shining, red-stemmed Moss is distinguished from *H. purum* by the absence of the apiculus in the leaves, which are almost nerveless, and the oblong not ovate sporangium.

\*\* *Leaves nerved halfway.*

52. *H. purum*, *L.*; stem erect, forked; branches simply pinnate; leaves closely imbricated, concave, turgid, elliptic with a reflexed apiculus, narrow at the base; nerve reaching halfway; fruitstalk even; sporangium elliptic, regular, horizontal; lid conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1599, 2189, f. 2.*; (Plate 8, fig. 3); *Moug. & Nest. n. 44.*

On shady banks. Very common. Bearing fruit, though not commonly, in autumn.

Dioicous; forming soft tufts of a very pale green. Branches pinnate, obtuse; leaves broadly elliptic, narrow at the base, where the cells are larger, entire, glossy, membranous; nerve reaching about halfway; margin recurved at the base; fruitstalk even, an inch long, brittle; sporangium ovate, horizontal, cernuous; lid conical.

*Leaves obscurely serrate.*

Used by anglers to scour worms. The teeth of the peristome are narrower than in the last, broadly lamellate, and other differences will be found on comparison.

C. *Stem simply, doubly, or triply pinnate, erect, tomentose or rough with paraphylla; fruit from the upper part of the stem.*

\* *Leaves papillose.*

53. **H. Blandovii**, *Web. & Mohr*; stem bi-tripartite, clothed with lacinate down-like paraphylla, branchlets distichous, crowded; stem-leaves cordate, acuminate, plicate; branch-leaves ovate, all more or less papillose behind, sharply toothed; margin recurved, nerve reaching almost to the tip; sporangium subcylindrical, curved, cernuous; lid conical.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 2760.*; (Plate 8, f. 5); *Thuidium Blandovii*, *Schimp.*

In bogs. Rare. Bearing fruit in early summer.

Monoicous; forming tall, dense, pale-green tufts. Stems erect, divided, divisions pinnate; branches crowded, spreading, the lower drooping, flagelliform and rooting at the tips, clothed with jagged, much-branched, down-like paraphylla; leaves subcordate on the stem, narrow on the branches, acute or acuminate, imbricated, spreading, glossy, papillose beneath, sharply keeled, more or less sulcate; margin recurved, often ciliated below; fruitstalk 2 inches long, reddish, even; sporangium oblong, subcylindrical, curved, cernuous; lid conical, pointed.

The rhomboid reticulations separate this from the species referred to the genus *Thuidium*, with which it agrees in habit and in the papillose leaves.

\*\* *Leaves even.*

θ. **HYLOCOMIUM**, *Schreb.*\*

54. **H. splendens**, *Sibth., Hedw.*; stem suberect, inter-

\* Pinnate, bipinnate, etc.; leaves shining, scarious; upper leaf-cells very narrow.

ruptedly bi-tripinnate, villous; leaves imbricated, ovate or elliptic, concave, pointed, serrated, two-nerved at the base, where the margin is reflected; sporangium ovate, cernuous; lid rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1424.*; (Plate 9, fig. 1); *Moug. & Nest. n. 42.*

On the ground, in woods, etc. Common. Bearing fruit, but rarely, in April.

Dioicous; forming loose tufts several inches in length. Stems with frequent and often repeated innovations, which are bi-tripinnate; leaves glossy, elliptic, smooth, those of the stem with a long point, those of the branchlets pointed but blunt, serrated, two-nerved at the base, where the margin is reflected; fruitstalks generally two or three together, even, about an inch long; sporangium ovate, cernuous; lid large, rostrate.

A noble species, sometimes attaining the length of a foot, but bearing fruit rarely in the southern counties. In the south of Europe it is alpine and subalpine, but proceeding northwards it descends to the plains.

55. *H. umbratum*, *Ehr.*; stem suberect, irregularly bipinnate, clothed with branched paraphylla; leaves cordate or ovate, acuminate, sharply toothed, more or less plicate; nerve often forked; fruitstalk even; sporangium ovate, cernuous; lid conical, acute.—*Hook. & Wils. t. lvii.*; (*Moug. & Nest. n. 329.*)

In alpine woods, rare. Scotland. Bearing fruit in winter.

Dioicous; forming loose yellowish tufts. Stems more or less regularly bipinnate, producing innovations as in the last, clothed with numerous, branched paraphylla, the ultimate divisions very acute; leaves rather distant, spreading, smooth, glossy, those of the stem broadly cordate, deeply plicate, those of the branches ovate or ovate-oblong, striate, sharply ser-

rated with two or occasionally three nerves, often more or less combined, and reaching halfway up; cells narrow; perichætical leaves large, serrate, their tips spreading; fruitstalk even, twisted when dry; sporangium ovate, turgid, cernuous; lid conical, with an acute apex.

Allied to the last, but distinguished by the conical lid, plicate leaves, and less regular and frequent divisions.

56. *H. Oakesii*, *Sull.*; stem arched, distantly pinnato-ramulose, clothed with branched, down-like paraphylla; leaves subelliptic or ovato-oblong, concave, slightly plicate, with the margin strongly reflexed, apiculate; more or less serrate above; furnished with two nerves at the base, which are often more or less combined; fruitstalk even; sporangium ovate, cernuous; lid conical, with a short beak.—*Hook. & Wils. t. lvii.*

Found at present only on Ben Lawers. Bearing fruit in autumn and early spring.

Dioicous; forming green tufts. Stem red, with frequent arched innovations, which are distantly pinnate, clothed with repeatedly-branched down-like paraphylla; leaves moderately crowded, concave, roundish-elliptic, with an abrupt apex, or ovate and more acuminate, more or less striate, minutely serrate above; perichætical leaves squarrose; fruitstalk 1 inch long, even; sporangium short, ovate, cernuous; lid conical, with a short, straight, or curved beak.

Of a brighter green than the last, and less divided; the margin of the leaves much reflected, and the lid longer. The degree in which the leaves are serrated seems to vary much. Schimper says they are more deeply serrated than in the last; Wilson figures them as coarsely serrated, though not so strongly; while in authentic specimens from Sommerfelt, I find the serratures minute. The paraphylla are far more deeply and intricately divided.



57. *H. brevirostre*, *Ehr.*; stem erect, arched, clothed with branched paraphylla, bipinnato-ramulose; stem-leaves widely spreading, subsquarrose, suddenly acuminate, plicato-striate; branch-leaves spreading, ovate, acuminate; all toothed and two-nerved; sporangium ovate, cernuous; lid conical, subrostrate.—*Hook. & Wils. t. lvii.*; *Eng. Bot. t. 2865.*; (Plate 9, fig. 2); *Moug. & Nest. n. 423.*

In mountainous woods. Scotland, England, Ireland, and Wales. Bearing fruit in winter.

Dioicous; forming green, loose tufts, several inches in length. Stem erect, arched, proliferous; innovations irregularly bipinnate, often rooting at the tips, clothed with branched paraphylla, whose extreme divisions are very acute; stem-leaves squarrose or occasionally secund, cordate or even deltoid at the base, with distinct auricles, strongly toothed, abruptly acuminate, two-nerved, the nerves generally united for some distance; stem-leaves more ovate and less abruptly acuminate; cells narrow, not sensibly enlarged below; fruit-stalk even, about an inch long; sporangia solitary or aggregate, ovate, turgid, thin, somewhat translucent, horizontally cernuous; lid conical, with a short, oblique, cylindrical beak, which has a little distinct point at the tip.

Far more robust than *H. umbratum*, and very distinct in the leaves and subrostrate lid.

D. *Stem more or less erect, pinnate, without paraphylla, bearing fruit in the upper part; leaves more or less squarrose.*

58. *H. squarrosus*, *L.*; stem slender, mostly erect, slightly divided, with a few scattered branchlets; stem-leaves crowded, concave, broadly ovate below and erect, attenuated upwards and reflected, slightly serrated, substrate and two-nerved at the base; branch-leaves smaller, less squarrose; fruitstalk

even; sporangium ovate, turgid, cernuous; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1953.*; (Plate 10, fig. 1); *Moug. & Nest. n. 233.*

Pastures, woods, etc. Extremely common. Bearing fruit, but rarely, in winter.

Dioicous; forming green, soft tufts, about 2 inches high. Stem generally erect, but sometimes arched or slightly procumbent, sparingly divided with a few distant branchlets which sometimes root at the extremity; stem-leaves densely crowded, broadly ovate below and erect, strongly acuminate above, and suddenly curved back, slightly serrate, substriate, two-nerved at the base, or more rarely nerveless; cells narrow, with a few larger at the base; branch-leaves narrower, less squarrose, the terminal leaves being patent; perichæatial leaves recurved; fruitstalk about an inch long, even; sporangium ovate or roundish-ovate, cernuous; lid conical, acute.

Distinguished from *H. loreum* by its scarcely striated, squarrose, and by no means secund leaves, and from *H. triquetrum* by its slender stems, smaller size, less cordate and less striated leaves.

59. *H. triquetrum*, *L.*; stem ascending, simple, or with fasciculate somewhat pinnate branches; stem-leaves squarrose, sulcate; branch-leaves spreading; all more or less deltoid or cordate below, acuminate, serrate two-nerved; fruitstalk even; sporangium ovate, cernuous.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1622.*; (Plate 9, fig. 3); *Moug. & Nest. n. 235.*

In woods, on banks, etc. Very common. Bearing fruit in winter and early spring.

Dioicous; forming tall, stiff, shining tufts, several inches long, of a yellowish-green. Stems red, ascending, arched, nearly simple or branched, principally by means of innovations, in a fastigiate manner, smooth; stem-leaves squarrose, deeply

sulcate; branch-leaves narrow, spreading; all more or less deltoid and amplexicaul at the two-nerved base, attenuated upwards, and finely serrate; fruitstalk even, about 1 inch high; sporangia short, mostly aggregate, roundish-ovate; lid conical, rather acute.

In this, as also in *H. squarrosum* and *H. loreum*, the sporangium when dry is frequently slightly ribbed. The species is much used for packing on account of its elasticity.

60. *H. loreum*, *L.*; stem ascending, arched, simple or dichotomous; branches irregularly pinnate; branchlets elongated, often rooting at the end; leaves crowded, variously directed, ovato-lanceolate, acuminate, minutely toothed, faintly two-nerved, and sulcate at the base; fruitstalk even; sporangium roundish-ovate, horizontal; lid conical, apiculate.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 2072.*; (Plate 9, fig. 4); *Moug. & Nest. n. 232.*

In mountainous woods. Bearing fruit, but rarely, in winter and early spring.

Dioicous; forming soft, green or olivaceous tufts, some inches long. Stem more or less erect, or at least ascending, the branches more or less pinnate; branchlets often rooting at the tips; leaves squarrose, subsecund or even falcate above, ovato-lanceolate, strongly acuminate, slightly serrate, sometimes auriculate, deeply grooved, sometimes nerveless, but generally with two faint veins at the base; cells narrow throughout; fruitstalk twisted, an inch or more long, even; sporangium subglobose, sulcate when dry, horizontal; lid large, conical, with an acute apex.

*υ. HYCOMIUM, Schimp.\**

61. *H. flagellare, Dicks.*; stem arched, proliferous; branches

\* Separated by Schimper from *Eurynchium*, on account of its conical, not rostrate beak, and slight differences in the reticulation of the leaves.

pinnate; stem-leaves squarrose, broadly cordate, acuminate; sharply toothed, two-nerved, subplicate; branch-leaves spreading, subsecund, ovato-lanceolate, sometimes nerveless; paraphylla lanceolate, toothed; fruitstalk rough; sporangium oval, cernuous; lid convex, apiculate.—*Hook. & Wils. t. lvii.*; *Eng. Bot. t. 2565.*; (Plate 9, fig. 5); *Moug. & Nest. n. 1225.*

On rocks in mountainous districts, principally near waterfalls, Lancashire, Ireland and Wales. Bearing fruit, but rarely, in early winter.

Dioicous; forming soft green or at length yellowish-green tufts or patches. Stems short (at least in the fertile plant), ascending, arched, proliferous, slightly divided; branches pinnate; branchlets often curved, elongated and rooting at the tips; stem-leaves broadly cordate, acuminate, serrated, more or less plicate, two-nerved at the base where the cells are large; paraphylla lanceolate, sharply toothed; branch-leaves narrow, less squarrose, and acuminate, often nerveless; perichæatial leaves with a long rough hair-like tip; fruitstalks very rough, 1 inch long, red; sporangium elliptic, swollen, curved, cernuous; lid convex, with a distinct acute apiculus.

The fertile plant is always shorter than the sterile, which is often much elongated, especially when growing in water. Wilson does not mention the paraphylla, but I find them in specimens gathered by himself at Aber.

Sect. II. *Leaves secund.*

A. *Stem pinnate, more or less erect, fructification near the middle; leaves falcato-secund.*

\* *Leaves nearly entire; nerve reaching halfway or more.*

η. HYPNUM, *Schimp.*

62. H. *Kneiffii*, *Schimp.*; dioicous; stem ascending; branchlets subpinnate; leaves distant, subsecund, cordato-lanceo-

late, acuminate, entire ; nerve reaching halfway ; perichæatial leaves deeply sulcate ; fruitstalk even ; sporangium subcylindrical, curved, cernuous ; lid conical.—*Hook. & Wils. t. lviii.*

In swamps, from Lancashire to Sussex. Bearing fruit in June.

Forming soft, loose tufts. Stem-leaves broadly cordato-lanceolate, much attenuated, entire, with a nerve reaching more than halfway up ; branch-leaves narrower ; cells narrow, larger at the base ; fruitstalk 2 inches long ; sporangium subcylindrical, curved, with a long neck below the spore-sac.

Distinguished from *H. fluitans* by its being dioicous, and in its leaves being broader and shorter, with looser reticulations at the base, and from *H. aduncum* in the more distant, less truly secund, broader leaves, and shorter and more slender nerve.

63. *H. aduncum*, *L.* ; dioicous ; stem erect, slightly divided, pinnato-ramulose ; branchlets short, uncinatè, widely spreading ; leaves crowded, circinate or falcato-secund, lanceolate, acuminate, striated ; nerve thick, reaching nearly to the tip ; fruitstalk even ; sporangium oblong, curved, cernuous ; lid conical.—*Hook. & Wils. t. xxvi.* ; (Plate 10, fig. 2) ; *Moug. & Nest. n. 1321.*

In marshes. In several places in England. Bearing fruit from April to June.

Forming loose, fastigate, yellowish-green or tawny tufts, 2 inches or more long. Stem slightly divided ; branches pinnate ; branchlets short, curved ; leaves crowded, falcato-secund or circinate, narrow, lanceolate, acuminate, entire or obscurely serrate below, more or less striate ; nerve strong, reaching nearly to the tip ; reticulations narrow, loose towards the base, broad at the angles ; fruitstalk an inch long, even ; sporangium cylindrical, slightly curved, cernuous ; lid conical, pointed.

64. *H. lycopodioides*, *Neck.*; dioicous; stem suberect, slightly divided; branches subpinnate; branchlets curved at the tip; leaves crowded, falcato-secund, ovato-lanceolate, strongly acuminate, entire, soft and membranous; nerve reaching almost to the tip; sporangium oblong, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Eng. Bot. t. 2250 in part*; (*Moug. & Nest. n. 628.*)

In marshes in various parts of England and Scotland, also on the sands of Barrie. Bearing fruit, but rarely, in summer.

Forming soft, yellow green or brownish but not purple tufts, several inches long. Stem suberect, or sometimes decumbent, slender, slightly dichotomous; branches irregularly pinnate, the pinnæ of various lengths, curved at the apex; leaves falcato-secund, ovate below, much attenuated at the tips, not sulcate, entire; nerve reaching almost to the tip; cells dilated at the angles; perichæatial leaves longer, nerved, sulcate; fruitstalk even; sporangium oblong, curved, cernuous, with a very broad ring; lid conical, with a mammillary point.

A very fine and beautiful species, much stouter than its neighbours, remarkable for the softness of its texture. The specimens in Mougeot and Nestler are barren. The paler plant alone in *Eng. Bot.* belongs to this species.

65. *H. fluitans*, *Dill.*; monoicous; stem erect or floating, elongated, dichotomous, more or less pinnato-ramulose; leaves distant, falcato-secund, lanceolate, acuminate, slightly serrate above, not striate; nerve reaching to the tip; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. lvi.*; *Eng. Bot. t. 1448*; (Plate 10, fig. 3); *Moug. & Nest. n. 526.*

In meadows, marshes, peat-bogs, etc. Common. Bearing fruit in early summer.

Forming long, submerged or floating tufts, of a yellowish or brownish green. Stems dichotomous; branches pinnate or

subpinnate; stem-leaves remote, mostly spreading, except above; branch-leaves falcate; all more or less lanceolate, narrowly acuminate, nearly entire, often twisted; nerve reaching almost to the tip; cells narrow, dilated below; fruitstalk 2 inches or more long, even, pale red; sporangium oblong, curved, cernuous; lid conical, acute.

Varying very much according to the situation in which it grows. The fruit is sometimes very abundant. Nearly allied to *H. riparium*, and distinguished principally by its narrow, more tapering, falcate leaves, and longer nerve.

66. *H. revolvens*, *Swartz*; monoicous; stem suberect, irregularly divided; branches subpinnate; branchlets distant; leaves crowded, circinato-secund, ovato-lanceolate, more or less acuminate, concave, slightly toothed; nerve reaching above halfway; perichæatial leaves striated; sporangium oblong, cernuous; lid conical, apiculate. — *Hook. & Wils. t. lviii.*; *Eng. Bot. t. 2073.*; (Plate 10, fig. 4); *Moug. & Nest. n. 1319.*

In bogs and marshes, chiefly in mountainous districts. Bearing fruit in spring.

Forming soft purplish tufts. Stem flaccid, erect or procumbent; branches more or less pinnate; branchlets curved at the tip; leaves densely crowded, falcate, secund, concave, shining, ovate at the base, attenuated upwards, entire or obscurely serrate; nerve reaching more than halfway up, sometimes in contiguous leaves, double; cells narrow, not enlarged below; perichæatial leaves striated; fruitstalk 1 inch high, even; sporangium oblong, curved, cernuous; lid conical, acute.

Leaves much broader at the base, more crowded, falcate, and with a shorter nerve.

\*\* *Leaves decidedly serrate; nerve reaching above halfway.*

67. *H. uncinatum*, *Hedw.*; monoicous; stem suberect or

prostrate, pinnato-ramulose; branchlets falcate; leaves crowded, circinato-falcate, lanceolate with a subulate tip, plicate, toothed; nerve reaching above halfway; sporangium subcylindrical, arcuate, cernuous; lid conical.—*Hook. & Wils. t.* xxvi.; *Eng. Bot. t.* 1600.; (Plate 11, fig. 1); *Moug. & Nest. n.* 335.

In watery, stony places in alpine or subalpine districts, but not in marshes. Bearing fruit in summer.

Forming pale yellowish-green tufts or patches, varying much in length. Stem suberect or prostrate, slender, slightly branched; the branches more or less pinnate, the branchlets falcate above; leaves crowded, falcate, secund, broad at the base, striate, lanceolate with a subulate, curved, toothed apex; nerve slender, reaching more than halfway; cells very narrow, loose at the base, especially at the clasping angles; perichæcial leaves very long, nerved, striate; fruitstalk even, 1 inch long, reddish; sporangium subcylindrical, curved, cernuous, or suberect; lid conical, acute; ring distinct.

The monoicous inflorescence, paler colour, more rigid stem, more falcate, decidedly toothed, sulcate leaves, which are broader at the base, and the elongated, subcylindrical sporangium distinguish this from *H. aduncum*. It is, however, extremely variable according to the situation in which it grows, and its greater or less subjection to moisture.

67\*. *H. exannulatum*, *Gümb.*; dioicous; stem erect or procumbent, pinnate; leaves secundo-uncinate, auriculate; nerve reaching to the tip; perichæcial leaves even, shortly acuminate; sporangium curved; lid shortly conical; ring wanting.—*Bryol. Eur. t.* 620.

In watery places, Cheshire. Bearing fruit in early summer.

Distinguished from *H. uncinatum* by the dioicous inflorescence, exannulate sporangium, and other points.



68. *H. commutatum*, *Hedw.*; dioicous; stem dichotomous, mostly prostrate; branches pinnate, downy, leaves circinato-secund, rather distant, ovato-lanceolate, striate, acuminate slightly serrate; nerve very strong, reaching nearly to the apex; sporangium subcylindrical, curved, cernuous; lid conical, acute.—*Hook. & Wils. t. xxvii.*; *Eng. Bot. t. 1569, 2250 in part*; (Plate 10, fig. 5); *Moug. & Nest. n. 523.*

In watery places, especially where the soil is calcareous. Bearing fruit in spring.

Forming green or yellow-green tufts of various length. Stem erect or procumbent, clothed with rufous down; branches pinnate; leaves rather distant, but sometimes closer, falcate, secund, broad at the base, ovato-lanceolate, slightly toothed, sulcate, twisted when dry; nerve pale, strong, reaching nearly to the tip; cells very narrow, except at the angles; perichætical leaves sulcate, strongly nerved; fruitstalk an inch or more long, even, red; sporangium oblong, curved, cernuous; lid conical, with a sharp apex.

Differs from *H. filicinum* in the plicate leaves, which are not so broad at the base, twisted when dry, and the narrower cells.

In calcareous water, as, for example, in Northamptonshire, it is frequently incrustated below with carbonate of lime, the tips of the branches alone being free.

69. *H. filicinum*, *L.*; dioicous; stem ascending, at length villous; branches more or less pinnate; leaves spreading, falcato-secund, ovate or ovato-lanceolate, even, acuminate, serrated; nerve reaching nearly to the apex; sporangium oblong, slightly curved, cernuous; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 1570, 2126.*; (Plate 10, fig. 6); *Moug. & Nest. n. 228.*

In watery places, especially in subalpine districts. Bearing fruit in spring.

Forming green tufts. Stems more or less clothed with branched rootlets; branches simple or pinnate; stem-leaves deltoideo-ovate, branch-leaves ovato-lanceolate, all secund, more or less acuminate, serrate; nerve strong, reaching almost to the tip, sometimes excurrent; cells loose, especially at the base; fruitstalk about an inch long, even; sporangium oblong, curved, cernuous; lid conical, acute.

Varying much in size, ramification, and general habit, but distinguished easily from the last by the leaves not being twisted when dry, and by their larger cells. The branched down in this and the last species seems rather to be of the nature of rootlets than a modification of leaves (paraphylla) as in *H. brevirostre* and its allies.

70. *H. rugosum*, *Hedw.*; dioicous; stem ascending, stout, irregularly divided; branches pinnate; branchlets recurved; leaves crowded, falcato-secund, ovato-lanceolate, acuminate, falcate, toothed, corrugated; nerve reaching about halfway; sporangium subcylindrical, curved, cernuous; lid shortly rostrate.—*Hook. & Wils. t. lviii.*; (*Moug. & Nest. n. 231.*)

On exposed rocks, on heaths and sand-hills, principally in subalpine districts. Bearing fruit in summer.

Forming tawny or yellowish-green tufts. Stem erect or ascending, slightly divided; branches pinnate; pinnæ sometimes however confined to one side; leaves rather crowded, secund, falcate, transversely corrugated, ovato-lanceolate, acuminate, concave, sharply toothed; those on the branchlets often erecto-patent; margin recurved; nerve reaching about half-way, slender; fruitstalk an inch or more long, even, red; sporangium oblong, slightly curved when fresh; lid with a short oblique beak.

A noble species, rarely bearing fruit, and not likely to be confounded with any other, but somewhat resembling *H. ly-*

*copodioides*. It forms the subgenus *Rhytidium* of Schimper, separated principally on account of the waving of the leaves. The two kinds of fruit often grow in distinct tufts, and according to Wilson, where the perigonia occur, the antheridia are often imperfect.

\*\*\* *Leaves striated, nerveless or two-nerved, toothed.*

71. *H. Crista-castrensis*, L.; stem suberect, pectinate; leaves eircinato-secund, ovato-lanceolate, acuminate, plicate, toothed; two-nerved at the base; sporangium oblong, eurved, cernuous; lid conical.—*Hook. & Wils. t. xxvii.*; *Eng. Bot. t. 2108.*; (Plate 11, fig. 2); *Moug. & Nest. n. 140.*

In woods and on rocks in mountainous districts. Bearing fruit in summer.

Dioicous; forming yellow-green, loose tufts. Stem rigid, simple or producing one or two innovations, closely pectinate; branches slightly recurved, distichous, rarely forked; stem-leaves ovato-lanceolate, falcate, strongly attenuated, toothed, deeply sulcate, with two short nerves at the base, which are sometimes very faint; branch-leaves narrower and more eircinat: margin in all more or less recurved; paraphylla narrow lanceolate; perichæcial leaves sulcate; fruitstalk 1–2 inches long, even; sporangium oblong, cernuous, solid, more strongly, areuate when dry; lid convex.

Sometimes confounded with the next, but a much larger plant, with a larger sporangium and less acute lid. The pectinate arrangement of the branches gives the plant a feather-like aspect, from whence it derives its name.

72. *H. molluscum*, Hedw.; stem suberect or proeumbent, closely pinnate; leaves crowded, eircinat, secund, cordato- or ovato-lanceolate, acuminate, toothed, nerveless or two-nerved; sporangium short, ovate; lid conical, acuminate.—*Hook. & Wils.*

*t.* xxvii. ; *Eng. Bot. t.* 1327. ; (Plate 11, f. 3) ; *Moug. & Nest. n.* 141.

On the ground, rocks, etc., chiefly in calcareous districts. Common. Bearing fruit in winter.

Dioicous, forming soft, dense, yellow-green tufts or patches. Stem ascending or prostrate, pinnate ; pinnæ crowded, short ; leaves crowded, glossy ; stem-leaves cordate at the base, acuminate, toothed, spreading, slightly striate ; margin plain, toothed ; branch-leaves circinate, ovate at the base ; paraphylla ovato-lanceolate ; fruitstalk even, fleshy, scarcely an inch long, twisted when dry, reddish ; sporangium oval, short, cernuous ; lid conical, acuminate, half or two-thirds as long ; veil slightly hairy.

One of the most elegant of our Mosses, and generally producing fruit in great abundance, which is very persistent.

*B. Stem procumbent, more or less pinnate, fruit near the base.*

73. *H. hamulosum*, *Fröl.* ; monoicous ; stem procumbent, pinnate ; leaves circinato-secund, hamulose, ovato-lanceolate, acuminate, nerveless, serrated ; perichæatial leaves attenuated, erect ; sporangium subcylindrical ; lid conical, acuminate.—*Tab.* lviii.

Var.  $\beta$ , *micranthum*, *Wils.* ; faintly two-nerved ; lid more obtuse.—*Hook. & Wils. t.* lviii.

On alpine grassy declivities and in mountain woods. Bearing fruit in summer.

Stems about an inch long, slightly proliferous, pinnate ; leaves curved, hooked, ovate, strongly acuminate, serrate above, nerveless ; margin even ; fruitstalk 1 inch long, even ; sporangium subcylindrical, much contracted when dry.

Allied to the next, but with differently-shaped leaves and a different time of flowering. The male blossoms, according to

Wilson, either nestle in the axillæ of the leaves or are attached to their surface by radicles. Schimper refers it to *H. callichroum*, Brid., asserting that Wilson's specimens transmitted to him were dioicous. It should seem however that they are rather pseudomonocous. In specimens from the Highlands I find, in the same pinna, the leaves two-nerved and quite nerveless.

74. *H. cupressiforme*, L.; dioicous; stem procumbent, subpinnate; leaves falcato-secund, elliptico-lanceolate, acuminate, nearly entire, nerveless or two-nerved at the base; perichæatial leaves subpiliferous, erect; sporangium subcylindrical, curved, subcernuous; lid conical, rostellate or cuspidate.—*Hook. & Wils. t. xxvii.*; *Eng. Bot. t. 1860, 1620.*; (Plate 11, fig. 4); *Moug. & Nest. n. 229, 1228.*

On stones, trunks of trees, rocks, etc. Very common. Bearing fruit in winter.

Forming soft, pallid, or rarely dark-green or olivaceous patches. Stem procumbent, branched, more or less regularly pinnato-ramulose; leaves falcato-secund, concave, more or less broadly ovate or oval at the base, acuminate above, nerveless or faintly two-nerved; fruitstalk even; sporangium subcylindrical, curved, generally more or less cernuous, rarely suberect; lid more or less pointed or even rostrate.

One of the most variable of Mosses. Sometimes the stems are inclined to be erect and assume the tints of species of the same group as *H. aduncum*, sometimes the stem is not pinnate; the direction of the leaves also varies, as also the size; occasionally the leaves are almost eomplanate. Schimper refers to this *H. resupinatum*, Wils. (tab. xxvii.); *Eng. Bot. t. 1664*, a slender form, often confounded with *Pylaisia polyantha* on account of its erect sporangium and scarcely falcate leaves.

75. *H. pratense*, Koch; stem suberect, sparingly branched

or subpinnate, somewhat complanate; leaves complanato-secund, loose, ovato-lanceolate, nerveless; sporangium ovate or oblong, tapering at the base, cernuous; lid conical, rather blunt.—*Hook & Wils. t. lviii. (Moug. & Nest. n. 1322).*

Moist banks, pastures, fallow fields, etc., where the soil is calcareous. From Scotland to Sussex, occasionally. Fruit, not however yet found in England, produced in spring.

Dioicous, according to Wilson, or, according to Schimper, pseudomonocous; forming loose pale-green patches. Stems prostrate ascending or suberect, irregularly and sparingly branched or subpinnate; leaves loosely imbricated, sometimes much flattened, ovato-lanceolate, acute, sometimes falcato-secund, nerveless or faintly two-nerved, entire or slightly toothed above; margin plane; fruitstalk 2 inches long, even; sporangium ovate, tapering below, curved, cernuous; lid conical, rather obtuse.

Differs from every form of the last, according to Wilson, whether complanate or not in the acute not acuminate leaves, but they are certainly acuminate in specimens from Sussex. The pseudomonocous inflorescence, distinctly described by Schimper, is probably the most trustworthy character.

76. **H. ochraceum**, *Turn.*; dioicous; stem suberect, sparingly branched, flaccid; leaves secund, ovato-lanceolate, concave; nerve forked; perichæatial leaves recurved; sporangium cernuous, tapering at the base; lid conical.—*Hook. & Wils. t. lviii.*

On stones in and near alpine rivulets, Scotland, Ireland, and Lancashire. Bearing fruit in May and June.

Forming ochraceous tufts or patches. Stems erect or procumbent, sparingly branched; leaves more or less secund, sometimes falcate, concave, ovato-lanceolate, acute, scarcely acuminate, nearly or quite entire, with a forked or single nerve

at the base ; cells narrow, a few only at the angles being enlarged ; perichæatial leaves squarrose ; fruitstalk an inch long, even ; sporangium oval or oblong, curved, cernuous ; lid conical.

Varying in size from 2 inches to 6 ; fertile plants short.

77. *H. scorpioides*, *L.* ; stem erect or procumbent, elongated, dichotomous, irregularly pinnato-ramulose ; branchlets swollen, curved ; leaves falcato-secund, imbricated, very concave, round with an abrupt apiculus, entire, nerveless or two-nerved ; sporangium oblong, curved, cernuous ; lid conical, apiculate.—*Hook. & Wils. t. xxvii.* ; *Eng. Bot. t. 1039.* ; (Plate 11, f. 5) ; *Moug. & Nest. n. 522.*

In bogs, in various parts of the country. Bearing fruit, but rarely, in spring and early summer.

Dioicous, forming flaccid, greenish yellowish or chocolate-brown tufts often many inches long. Stems forked, branched, irregularly pinnate ; leaves even, entire, falcato-secund, imbricated, large, swollen, very concave, roundish or elliptic with a small abrupt apiculus, nerveless or faintly two-nerved at the base ; fruitstalk 2 inches long, even, reddish ; sporangium short, oblong, curved, cernuous ; lid conical, pointed.

A magnificent species, very different from those Bog Mosses to which it bears some external resemblance. It was formerly very abundant about Whittlesea Mere, acquiring many inches in length and occasionally bearing fruit. When growing on rocks, it is sometimes quite proeumbent. In some situations it is almost black, the young tips of the branchlets only being of a tawny green.

*C. Leaves secund, turned upwards.*

78. *H. incurvatum*, *Schrad.* ; monoicous ; stem creeping, subpinnate ; divisions curved at the tip ; leaves loosely imbric-

cated, subfalcate, curved upwards, oblongo-lanceolate, acuminate, nearly entire, nerveless or faintly two-nerved; sporangium shortly ovate, curved, cernuous; lid conical, acute.—*Hook. & Wils. t. lix.*; *Eng. Bot. t. 2839.*; (*Moug. & Nest. n. 934.*)

On shady walls and stones, chiefly in calcareous districts. Bearing fruit in summer.

Forming intricate, yellowish or darkish-green patches. Stem creeping, slightly divided, more or less pinnate, the divisions curved upwards; leaves oblongo-lanceolate, acuminate, curved upwards, entire or obscurely toothed, nerveless or shortly two-nerved; cells rather large; fruitstalk scarcely half an inch high, even; sporangium small, ovate, nearly horizontal; lid conical, acute.

Differing essentially from all forms of *H. cupressiforme* in its monoicous inflorescence. Its sporangium also is shorter, and the fruit ripens at a different season.

#### κ. PLAGIOTHECIUM, *Schimp.\**

79. *H. pulchellum*, *Dicks.*; monoicous; stem scarcely creeping; branches erect, fastigiate; leaves crowded, somewhat flattened, secund, directed upwards, ovato-lanceolate, tapering, entire, nerveless; sporangium oblong, subcernuous; lid conical, apiculate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 2006.*; (Plate 12, fig. 1.)

On shady rocks in mountainous districts or on roots of trees by rivulets. Scotland, Ireland, and North of England. Bearing fruit in summer.

Minute, forming dense, dark-green, glossy tufts or patches. Stem ascending; branches more or less erect, generally flat-

\* Separated principally on account of the flattened leaves, a character more strongly marked in the species of the next section.



tened, immersed at the base in a mass of rootlets; leaves secund, directed upwards, ovato-lanceolate, entire, nerveless; cells narrow, dilated at the base; fruitstalk short, inserted near the base of the fertile branch amongst the rootlets, as represented correctly in 'English Botany;' sporangium oblong, tapering at the base, curved, suberect; lid conical, pointed. Schimper considers Wilson's plant to be his *Hypnum nitidulum*, but this, according to Wilson himself, is a mistake.

80. *H. Muhlenbeckii*, *Br. & Schimp.*; monoicous; stem prostrate, slightly divided; branches and branchlets erect, tufted; leaves slightly flattened, spreading, ovato-lanceolate, acuminate, toothed, faintly two-nerved or nerveless; sporangium subcylindrical, curved, striated when dry; lid conical, blunt.—*Hook. & Wils. t. lix.*; *Eng. Bot. t. 2016.*

On rocks, or in hollows of grassy declivities in alpine districts. Scotland. Bearing fruit in summer.

Forming dense, short, green tufts. Stem prostrate, giving off erect branches and branchlets; leaves slightly flattened, shining, subsecund especially above, ovato-lanceolate, acuminate, toothed, nerveless or with two short nerves at the base, thin and transparent; cells rather loose, enlarged at the base; perichæcial leaves lanceolate, erect, toothed; fruitstalk even,  $\frac{2}{3}$  inch long; sporangium oblong, slightly curved, cernuous or suberect, striated when dry; lid short, conical.

Differs from the next in its more tufted mode of growth, more ovate shining leaves, and striated sporangium.

81. *H. silesiacum*, *Sel.*; monoicous; stem prostrate, slightly divided; divisions suberect, arched; leaves loosely imbricated, secund, directed upwards, oblongo-lanceolate, acuminate, slightly toothed, faintly two-nerved; sporangium elongated, curved, cernuous; lid conical.—*Hook. & Wils. t. lix.*; (*Moug. & Nest. n. 425.*)

On stems of decaying trees, etc. Observed at present only in Kent and Yorkshire. Bearing fruit in spring.

Forming pale-green tufts. Stem prostrate; branches and branchlets proceeding from the rooting base, arched; leaves secund, directed upwards, lanceolate or oblongo-lanceolate, strongly acuminate, obscurely if at all toothed; cells rather loose; fruitstalk an inch high; sporangium cylindrical, slightly arched, even; lid conical, obtuse.

The longer leaves and sporangia, besides the difference of habit, easily distinguish this species from the last. Wilson describes the leaves as more strongly toothed; but in Mougeot and Nestler's specimens they are very obscurely if at all toothed, which comes very near to Schimper's description.

Sect. III. *Leaves complanate; stems procumbent.*

82. *H. denticulatum*, *L.*; monoicous; stem prostrate, slightly branched, divisions erect; leaves complanate, inequilateral, ovate, apiculate, two-nerved; margin recurved; sporangium oblong, incurved, cernuous; lid conical, acute.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1260, 1446.*; (Plate 12, fig. 2); *Moug. & Nest. n. 46.*

In woods, on banks, etc., common. Bearing fruit in spring and summer.

Forming depressed, green, shining patches. Stem prostrate, slightly divided; branches and branchlets erect; leaves flattened, ovate or oblongo-ovate, inequilateral, attenuated upwards with a short apiculus, entire or slightly toothed above, with two short nerves at the base; margin recurved; cells narrow, larger at the base; fruitstalk about an inch long, reddish, produced at the origin of the branches; sporangium oblong, curved, cernuous; lid conical, acute.

When growing on wet rocks in alpine countries as repre-

sented in Eng. Bot. t. 1446, the leaves are more obtuse. Mr. Wilson finds a variety in which the margin of the leaves is nearly plane, and the inflorescence synoicous. The different inflorescence, and the non-rostrate beak separate this decidedly from *H. sylvaticum*.

83. *H. sylvaticum*, *L.*; dioicous; stem decumbent; leaves subcomplanate, ovato-lanceolate, shortly acuminate, entire, two-nerved, even; margin plane; sporangium subcylindrical, cernuous; lid shortly rostrate.—*Hook. & Wils. t. lix.*; *Eng. Bot. t. 2936.*; (*Moug. & Nest. n. 515.*)

On roots of trees, shady rocks, etc. Bearing fruit in early autumn.

Forming soft, deep-green patches. Stem decumbent, proliferous; branches few, subfasciculate; leaves flattened, but not so much so as in the last, distant, entire, opaque, ovato-lanceolate, attenuated upwards, but not strongly acuminate, two-nerved, contracted and furrowed when dry; margin plane; cells large; fruitstalk more than an inch long, pale, even; sporangium subcylindrical, cernuous; lid rostrate.

The rostrate beak, plane margin, and dioicous inflorescence will always distinguish this from the last.

84. *H. elegans*, *Hook.*; dioicous; stems prostrate; branches complanate; leaves complanate, ovato-lanceolate, oblique, slender pointed, obscurely toothed above, nerveless or two-nerved; sporangium ovate, more or less pendulous; lid conical, with a short beak.—*Hook. & Wils. t. lix.*; *Hook. Musc. Ex. t. 9.*; (Plate 12, fig. 3.)

On shady banks and rocks. Bearing fruit in spring.

Forming shining, pale-green patches. Stem prostrate, often proliferous; branches subpinnate, prostrate; leaves glossy when dry, distichous, complanate, ovato-lanceolate, attenuated, almost piliferous; tip obscurely serrated or entire; nerveless or

faintly two-nerved; cells very narrow; fruitstalk smooth; sporangium elliptic, sometimes cernuous, more frequently pendulous as in *Bryum*; lid conical, with a short beak or apiculus.

Distinguished at once from *H. denticulatum* by its glossy foliage, much narrower cells, rostrate beak, etc., and indeed having more the habit of some forms of *H. cupressiforme*. Received originally from Nootka. I do not find any notice of it in Schimper's 'Synopsis.'

85. *H. undulatum*, L.; dioicous; stem prostrate, prolific, branches mostly simple, complanate; leaves imbricated, ovato-oblong, apiculate, undulated transversely, with two short nerves at the base; sporangium cylindrical, cernuous, striated when dry; lid shortly rostrate.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1181.*; (Plate 12, fig. 4); *Moug. & Nest. n. 45.*

In woods and dry heathy places, especially in subalpine districts. Bearing fruit in spring and summer.

Forming whitish-green irregular tufts of various lengths, often amongst other Mosses. Stem slightly divided, sending out innovations clothed with small leaves; branches mostly simple, complanate, leaves ovato-oblong, attenuated upwards but not acuminate, entire, faintly two-nerved at the base; cells narrow, broader at the base; fruitstalk 2 inches long; sporangium cylindrical, curved, striate when dry, cernuous; lid with a short beak.

One of the finest of our Mosses, and most distinct. *Hypnum micans*, Wils.,—characterized by its dioicous inflorescence, prostrate, slender, filiform, sparingly branched stems, spreading, shining, subsecund, roundish, apiculate, concave, serrulate, obscurely two-nerved leaves,—is of very doubtful affinity in consequence of the female fruit being unknown. The patches are of a pale yellowish-green; the cells about as large as in *H. denticulatum*, with the exception of those at the angles,

which are remarkably large. In general appearance it resembles slender varieties of *H. cupressiforme*. Wilson suspects that it may eventually prove to be a *Leskea*.

### 9. PTYCHODIUM, *Schimper*.

Sporangium irregular or subcylindrical; peristome double; inner peristome short, without intermediate cilia or with nearly abortive processes.—*Mosses with plicate leaves* (πτυχώδης, plicate) and tomentose stems.

1. *P. plicatum*, *Schimp.*; dioicous; stem more or less procumbent, irregularly branched; leaves ovate, acuminate, subsecund, strongly plicate; margin entire, recurved; nerve strong, reaching nearly to the apex; sporangium horizontal or cernuous, nearly symmetrical.—*Hypnum plicatum*, *Wils. & Hook. p. 339, t. lv.*

In shady crevices on mountains. Ben Lawers. More common in Switzerland on calcareous than granitic rocks.

Dioicous; creeping below, above erect and irregularly branched, of a yellow glossy green, the branchlets often curved, in consequence of which the leaves are inclined to be secund, more or less covered with small multifarious paraphylla; leaves broadly ovate, very acuminate, entire, with a strong nerve reaching almost to the tip; cells narrow, elongated, hexagonal; fruitstalks principally on the main stem, short, springing from large pale perichæatial leaves, twisted below to the left when dry, and to the right above, smooth and shining, bright red; sperangium small, narrowly elliptic.

Schimper has separated this genus, which will not come under the definition given above of *Hypnum*, from *Brachythecium* on account of the tomentose stem, imperfect inner peristome, and different reticulation; and from *Camptothecium* for the two latter reasons, and its more symmetrical sporan-

gium. This Moss must be distinguished carefully from *Hypnum lutescens*.

#### 10. HETEROCLADIUM, *Br. & Schimp.*

Sporangium and peristome of *Hypnum*. Leaves slightly papillose at the back; marginal cells short, subquadrate, central cells elongated.

The generic distinction of this pretty little group rests more on the structure of the leaves, which is very different from that of *Hypnum*, than on their dimorphism, a circumstance which occurs in many true *Hypna*.

1. *H. dimorphum*, *Br. & Schimp.*; stem procumbent, irregularly pinnate; stem-leaves spreading and recurved, obcordate, acuminate; branch-leaves suberect, roundish, ovate, obtuse, all toothed and two-nerved; sporangium oblong, curved, cernuous; lid conical.—*Hook. & Wils. t. xxxv.*; *Grev. Sc. Crypt. Fl. t. 160.*; (*Moug. & Nest. t. 627.*)

Alpine rocks, Ben Lawers. Bearing fruit in winter and early spring.

Dioicous; forming little, intricate, yellow-green tufts. Stem procumbent, irregularly pinnate; stem-leaves cordate or ovate at the base, amplexicaul, acuminate, recurved; branch-leaves and occasionally those of the upper part of the stem more erect, ovate, roundish, obtuse or acute; all finely toothed and faintly two-nerved; marginal cells, as also those at the angles, subquadrate, short, with moderately thick walls; disk-cells elongated; paraphylla scattered, variously shaped, toothed or palmate; fruitstalk even, about  $\frac{1}{2}$  an inch long; sporangium oblong, curved, horizontal, with a short obtuse lid.

2. *H. heteropterum*, *Br. & Schimp.*; stem procumbent, branched, pinnato-ramulose, often flagelliform and rooting at the tip; stem-leaves spreading, subsecund, ovate, acuminate,

papillose, serrulate; branch-leaves ovato-lanceolate; nerve short, single or double; sporangium oblong, cernuous; lid rostrate.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 2297 in part.*

On rocks near waterfalls. Fruiting, but rarely, in Nov.

Dioicous; forming thick, intricate, dark green tufts. Stems procumbent, rigid, branched with pinnate branches; the pinnales often flagelliform and rooting; stem-leaves ovate, acuminate, sharply toothed; branch-leaves ovato-lanceolate, serrulate; all opaque, papillose, with a short, broad, faint nerve; cells of the margin and angles roundish, thick-walled, those of the centre more elongated; paraphylla ovate, acuminate, serrate; fruitstalk  $\frac{1}{2}$  an inch long, even; sporangium oblong, cernuous, slightly curved; lid rostrate, almost as long as the sporangium.

The leaves are far more opaque than in the last, and more or less oblique, and the cell-walls thicker, though the structure is essentially the same.

## 11. THUIDIUM, *Schimp.*

Sporangium and peristome of *Hypnum*; leaves strongly papillose, with numerous paraphylla; cells rounded, sub-hexagonal, except at the base.

The habit of the species belonging to this genus is peculiar, and their separation under a distinct genus is justifiable, on account of the difference of the structure of the leaves from that of *Hypnum*.

1. *T. tamariscinum*, *Br. & Schimp.*; stem arched, irregularly tripinnate; stem-leaves cordate, concave, sulate, acute; branch-leaves ovato-lanceolate; all slightly serrate above, strongly papillose, with the nerve reaching nearly to the apex; perichæatial leaves fringed; fruitstalk even; sporangium oblong, curved; lid rostrate.—*Hook. & Wils. t. lvii.*; *Eng. Bot. t. 1494.*; (Plate 8, fig. 4); *Moug. & Nest. n. 41.*

In woods and on banks. Common. Bearing fruit in November.

Dioicous; growing in loose, deep green tufts. Primary stem creeping, secondary erect, arched above, proliferous, irregularly tripinnate, clothed with numerous multiform, often branched paraphylla; branchlets slender, not rooting at the tip; stem-leaves ovate, acute; branch-leaves more obtuse, all of them papillose, with a subcontinuous nerve; margin even or slightly recurved; cells uniform, except a very few at the base, in which the primordial cell is very visible; perichæatial leaves consisting of long cells, fringed with threads; fruit-stalk red, 1 inch long; sporangium oblong, slightly arched; lid rostrate, about half as long.

Often used by the manufacturers of artificial flowers.

2. *T. delicatulum*, *Schimp.*; stem erect or decumbent, bipinnato-ramulose; branches attenuated, drooping, often rooting at the tip; stem-leaves cordate, acuminate, hispid, nerve reaching almost to the tip; sporangium subcylindrical, cernuous; lid conical, acute.—*Hook. & Wils. t. lvii.*; *Eng. Bot. t. 1495.*; (*Moug. & Nest. n. 1031.*)

On limestone rocks and on chalk hills, in several situations from Scotland to Sussex. Bearing fruit in summer.

Dioicous; forming dense tufts. Stems not proliferous, but bearing pinnate branches; leaves more widely ovate, acuminate, strikingly hispid, yellow-green, subplicate; nerve reaching nearly to the tip; margin slightly reflected; paraphylla various in shape, often leafy; perichæatial leaves not fringed; fruitstalk 1 inch high, paler, even; sporangium smaller, oblong, curved, cernuous; lid conical, half as long as the sporangium, acuminate.

Closely allied to the last, but differing in the hispid leaves, the less divided branches, absence of fringe on the perichæatial



leaves, and other points. I do not see any essential difference in the lid, which is sometimes as long in this as in the last species.

3. *T. abietinum*, *Br. & Schimp.*; stem erect, simple or bipartite; divisions simply pinnate; leaves crowded, imbricated, erecto-patent, subsecund, ovate, acuminate, deeply sulcate, papillose; margin reflexed; nerve reaching almost to the tip; sporangium cylindrical, slightly curved, subcervicous; lid conical, acuminate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 2037 in part*; (*Moug. & Nest. n. 226.*)

On dry banks, especially in calcareous districts, sand-hills, alpine rocks, etc. Bearing fruit, but rarely, in summer.

Dioicous; forming loose tufts, ochraceous below, yellowish above. Stem erect or decumbent, simple or forked, pinnate, clothed with abundant narrow lanceolate paraphylla; branches crowded, often flagelliform and drooping; leaves crowded, papillose at the back, sulcate; nerve strong, vanishing below the tip, channelled and rough at the back; stem-leaves broadly ovate, acuminate, deeply sulcate, toothed above; margin recurved; branch-leaves narrower, more even; cells small, roundish; perichætal leaves striate; fruitstalk 1 inch high; sporangium oblong, curved, cervicous; lid acuminate.

Frequently when the stem is prostrate it throws out several erect branches which are simply pinnate, like those of more normal growth. The structure of the leaves in *H. Blandovii* is so completely that of *Hypnum*, that I have left it in the neighbourhood of *H. splendens* and other nearly allied species.

## 12. PSEUDOLESKEA, *Br. & Schimp.*

Sporangium and peristome as in *Hypnum*, the intermediate cilia sometimes abortive; leaves papillose; cells all more or less quadrate.

Closely allied to *Heterocladium*, but differing in the structure of the leaves.

*P. atrovirens*, *Br. & Schimp.*; stem prostrate, much branched, pinnato-ramulose; branches suberect; leaves imbricated, secund, ovato-lanceolate, attenuated, slightly toothed; margin recurved; nerve reaching nearly to the tip, sporangium oblong, cernuous; lid conical.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 2422.*; (*Moug. & Nest. n. 521.*)

Alpine rocks and roots of trees. Scotland. Bearing fruit in spring.

Dioicous; forming dark-green depressed tufts. Stem branched; branches pinnate; branchlets mostly erect, incurved; leaves dark, brown-green, more or less secund, crowded, subpapillose, ovato-lanceolate, acuminate, slightly serrated or entire; nerve strong, reaching almost to the apex; cells roundish or subquadrate with thick walls; margin recurved; paraphylla numerous, multiform, often reduced to mere threads; fruitstalk  $\frac{1}{2}$  an inch high, even; sporangium short, oblong, slightly curved, cernuous; cilia often abortive; lid conical.

Leaves very different from those of *Hypnum*, and more resembling those of *Leptodon*.

2. *P. catenulata*, *Br. & Schimp.*; stem creeping; branches subpinnate; branchlets erect, filiform; leaves minute, imbricated, ovate, acute, entire; nerve reaching halfway; margin recurved at the base; sporangium oblong, curved, subcernuous; lid rostrate.—*Hook. & Wils. t. lv.*; (*Moug. & Nest. n. 1220.*)

On alpine and subalpine rocks. Scotland and Yorkshire. Bearing fruit in summer.

Dioicous; forming intricate brownish-green tufts. Stems thread-shaped, creeping, branched; branches subpinnate, suberect, often slightly curved; leaves minute, spreading when moist, closely imbricated when dry, papillose, ovate, acute, entire; margin strongly reflected below; nerve strong, reach-

ing about halfway; paraphylla thread-shaped, simple, or branched; fruitstalk about  $\frac{1}{2}$  an inch long; sporangium oval, oblong, suberect or cernuous; cilia of inner peristome delicate, but not abortive; lid rostrate.

The rostrate beak, shorter nerve, and more ovate leaves distinguish this from *P. atrovirens*.

ORDER VI. *ISOTHECII*, Br. & Sch. (*Leucodonteis inclusis*.)

Stems with the imbricated leaves cylindrical; leaf-cells narrow and rhomboid, or small and suborbicular; sporangia erect, symmetrical; peristome single or double; inner peristome when present without intermediate cilia; calyptra hood-shaped.

1. *Leaf-cells with their walls hexagonal, rhomboid, or linear, sometimes quadrate at the angles of the leaves.*

13. *ISOTHECIUM*, *Brid.*

Sporangium erect, cylindrical; ring deciduous; peristome double; inner membrane divided halfway down into 16 keeled perforate processes, with obscure intermediate cilia; cells of the leaves narrow, elongated; primary stem creeping, secondary dendroid.

1. *I. myurum*, *Brid.*; secondary stem with fasciculate incurved branches; leaves ovato-oblong, shortly acuminate, toothed at the apex; nerve reaching halfway up; perichæatial leaves erect; sporangium ovate, narrow; lid conical, rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1566.*; (*Moug. & Nest. n. 331.*)

On walls and trees. Bearing fruit in early spring.

Dioicous; forming soft wide pale tufts. Primary stem creeping, throwing out secondary, erect, slightly procumbent stems, which are divided above in a dendroid manner; branches

incurved; leaves imbricated, ovato-oblong or oblong, shortly acuminate, minutely toothed at the apex only, with a faint single or forked nerve reaching halfway up; cells narrow, vermiform, those at the angles shorter, subquadrate; perichæatial leaves erect; fruitstalk about  $\frac{1}{2}$  an inch long; sporangium ovate, tapering below, erect, regular, rarely slightly inclined or bent; lid rostrate; outer teeth pale, adhering mostly to the inner peristome, sometimes more or less abortive; intermediate cilia often deficient.

*I. myosuroides* is with Schimper placed in *Hypnum*. Its recurved perichæatial leaves distinguish it, as well as their form, if it is considered as an *Isothecium*.

#### 14. CLIMACIUM, *Web. & Mohr*.

Sporangium subcylindrical, erect, symmetrical; peristome double; inner of 16 scalariform processes, longer than the outer teeth; columella exserted; primary stem or rhizoma creeping, secondary bare below, dendroid; cells of leaves narrow.

1. *C. dendroides*, *Web. & Mohr*; leaves ovate or ovato-lanceolate, erecto-patent, bisulcate, serrate above; perichæatial leaves nerveless; sporangium oval-oblong; lid rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1565.*; (Plate 13, fig. 2); *Moug. & Nest. n. 138.*

In meadows, bogs, and marshes. Bearing fruit, though rarely, in autumn.

Dioicous. Rhizoma creeping, throwing up erect stems, which are void of branches below and divided above in a dendroid manner; leaves ovate or ovato-lanceolate, pointed, toothed in the upper half, with a single furrow on either side, nerve reaching nearly to the tip; cells narrow, except at the base and angles; fruitstalks about an inch long, aggregate; sporangium erect; columella exserted when dry, and raising

up the lid, which is attached to it (systylous) ; outer teeth narrow, confluent at the base, reddish ; inner yellow.

A fine species, but seldom in fruit, as the male plants often grow completely detached, though sometimes they accompany the female.

### 15. CYLINDROTHECIUM, *Br. & Schimp.*

Sporangium cylindrical, erect ; peristome double, inserted below the orifice ; inner peristome of 16 narrow teeth without intermediate cilia ; stem pinnato-ramulose ; cells narrow, elongated except at the angles.

1. *C. Montagnei*, *Br. & Schimp.* ; branches recurved, acute ; leaves imbricated, erecto-patent, ovate or ovato-oblong, sub-acute, entire, faintly two-nerved ; sporangium cylindrical ; lid conical.—*Hook. & Wils. t. liv.* ; *Mont. Ann. d. Sc. Nat. ser. 2, v. 20, t. 15.* ; (*Moug. & Nest. n. 1229.*)

On rocks and hills. Occasionally from Scotland to Sussex. Often perhaps confounded with *Hypnum Schreberi*. Bearing fruit on the Continent in autumn.

Dioicous ; forming pale broad yellow-green patches, ochraceous below. Stems pale, pinnate, the branches, short, recurved, and acute ; leaves imbricated, especially when dry, elliptic, ovate, or ovato-oblong, shortly pointed, entire, with two faint nerves or nerveless ; margin recurved at the base, where the cells are shorter ; sporangium cylindrical ; lid conical.

It may be known at once when barren from *H. Schreberi* by the pale not deep red stem, and the more pointed branches.

### 16. PYLAISIA, *Schimp.*

Sporangium erect, symmetrical ; orifice narrow ; peristome double, outer inserted far below the orifice, intermediate cilia absent or only rudimentary ; stem pinnate ; leaf-cells narrow, except at the angles, where they are quadrate.

1. *P. polyantha*, *Schimp.*; stem creeping; branches crowded, arched above; leaves turned upwards, secund, ovate, strongly acuminate, nerveless or faintly two-nerved, entire; sporangium oblong; lid conical, pointed.—*Hook. & Wils. t.* xxxv.; *Eng. Bot. t.* 2871.; *Grev. Sc. Crypt. Fl. t.* 161.; (Plate 12, fig. 5); *Moug. & Nest. n.* 39.

On trunks of trees. In the north and west of Great Britain. Bearing fruit in early autumn.

Monoicous. Stems creeping, slightly divided; branches pinnato-ramulose, erect, curved at the tips; leaves densely crowded, patent or subsecund and turned upwards, nerveless, entire or slightly toothed, shining, ovato-lanceolate, acuminate; reticulation narrow, broad at the base; fruitstalk  $\frac{1}{2}$  an inch long; sporangium elliptic-oblong, erect; lid conical, apiculate; peristome inserted below the mouth of the sporangium, as in *Tayloria*; inner peristome with very short or destitute of intermediate cilia.

The peculiar insertion of the peristome is perhaps the strongest generic character.

### 17. HOMALOTHECIUM, *Schimp.*

Sporangium symmetrical, erect; peristome double, inner with no intermediate cilia; veil rather large, more or less pilose; leaf-cells very narrow.

1. *H. sericeum*, *Schimp.*; stem creeping, branched; branches distichous, erect, crowded; leaves imbricated, erecto-patent, plicate, ovato-lanceolate, acuminate, minutely toothed; nerve reaching nearly to the apex; fruitstalk rough; sporangium erect, subcylindrical; lid conical, acute.—*Hook. & Wils. t.* xxv.; *Eng. Bot. t.* 1445.; (Plate 12, fig. 6); *Moug. & Nest. n.* 225.

On trees, stone walls, etc. Very common. Fruit ripe in winter and spring.

Dioicous; forming soft, silky, yellow-green patches. Stem creeping; branches short, crowded, erect, often curved; leaves erecto-patent, sometimes subsecund, ovato-lanceolate, strongly acuminate, plicate, very minutely toothed; cells narrow, but slightly altered at the base; fruitstalk rough, about an inch long, reddish; sporangium ovato-cylindrical, symmetrical, erect; lid conical, gradually attenuated into a short beak; intermediate cilia absent.

### 18. ORTHOTHECIUM, *Schimp.*

Sporangium erect, symmetrical; ring broad, dehiscent; veil small; peristome double; teeth of inner peristome as long as those of the outer; intermediate cilia wanting or rudimentary; leaf-cells narrow, not quadrate at the angles.

1. *O. rufescens*, *Schimp.*; stem erect, tufted; branches erect, slightly compressed; leaves erecto-patent, lanceolate, strongly acuminate, plicate, entire, nerveless; sporangium oblong; lid conical, acuminate.—*Hook. & Wils. t. xxvi.*; *Eng. Bot. t. 2296*; (*Moug. & Nest. n. 514.*)

On moist shady rocks near waterfalls, in alpine and especially calcareous districts. Bearing fruit in summer.

Dioicous; forming silky, soft, rufous tufts. Stem 2 or 3 inches high, erect or sometimes procumbent, dichotomously branched; branches erect, fastigiate, with sometimes a few branchlets; leaves crowded, erecto-patent, lanceolate, strongly acuminate, repeatedly sulcate, entire, nerveless; cells extremely narrow even to the base, not enlarged at the angles; fruitstalk even, 1–2 inches long; sporangium oblong, erect, or very slightly inclined; lid conical, short, acute; inner peristome with short intermediate cilia.

2. *O. intricatum*, *Schimp.*; stem prostrate, branched; branches erect; leaves lanceolate, acuminate, erecto-patent,

subsecund, nerveless, entire, nearly even except when dry; sporangium ovato-oblong, suberect; lid conical, acute.—*Hook. & Wils. t. liv.*

On subalpine rocks. Barren in this country, bearing fruit on the Continent in summer.

Dioicous; forming dense rufous or purplish tufts. Stem more slender, delicate, divided; branches erect; leaves subsecund, tapering from the base, entire, nerveless; fruitstalk 1 inch long; sporangium slightly inclined, ovate-oblong; lid convex, acute; inner peristome with or without intermediate cilia.

Very nearly allied to *O. rufescens*, but differing in size, habit, and the form of the sporangium.

### 19. MYURELLA, *Schimp.*

Sporangium suberect, symmetrical; ring distant; peristome large; inner broad, with short intermediate binate cilia; leaf-cells hexagonal, loose. Branches filiform, closely imbricated, so as to look scaly; leaves papillose behind.

1. *M. julacea*, *Schimp.*; stem slender, suberect, slightly branched, divisions erect; leaves closely imbricated, roundish, ovate, obtuse or apiculate, concave, minutely serrate, nerveless; sporangium suberect, minute, oval-oblong, tapering below; lid conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 2525.*

On alpine rocks. Scotland and Yorkshire. Bearing fruit in summer.

Forming little, pale-glaucous and at length yellowish tufts, which are very brittle when dry. Stem erect or ascending, slightly branched; branches and branchlets erect, proliferous; leaves closely imbricated, roundish, obtuse, or pointed, nerveless or with a faint pair of nerves, very minutely toothed; reticulation subhexagonal, short, papillose behind; fruitstalk



$\frac{1}{2}$  inch high, even; sporangium small, with a distinct barren base; lid short, conical; inner peristome pale.

The generic name is intended to express the resemblance of the branches to a slender mouse-tail. The genus differs from *Leskea* in the reticulation.

## 20. PLATYDICTYA, Berk.

Sporangium erect, symmetrical, at length turbinate; peristome double, inner with or without intermediate cilia; leaf-cells large, nearly equal throughout; stem hair-like, confervoid.

1. *P. Sprucei*, Berk.; stem very delicate, ascending or creeping; branches and branchlets few; leaves distant, erectopate, narrowly ovate, acuminate, nerveless, nearly entire; sporangium erect, elliptic or turbinate; lid conical, acute.—*Hook. & Wils. t. liv.*

On shady subalpine rocks. North of England. Bearing ripe fruit in summer.

Dioicous; forming very short, thick tufts, with hair-like stems and branches; leaves distant, spreading, ovato-lanceolate, strongly acuminate, obscurely toothed above, nerveless, pellucid; cells large, nearly equal throughout; fruitstalk  $\frac{1}{3}$  inch long; sporangium obovate, turbinate and wide-mouthed when dry; lid conical, acute; inner peristome with occasionally a few intermediate cilia.

I do not see how this Moss can be associated with Schimper's *Amblystegium*, still less with true *Leskeæ*. Its large uniform cells, erect sporangium, and imperfect inner peristome, all separate it widely from *Amblystegium*. As I know of no other genus in which it can be placed, I am forced to propose a new one for its reception.

21. **PHILOSCIA**, *Berk.*

Sporangium erect, symmetrical, tapering below; ring dehiscent; peristome double; teeth of outer peristome spreading and incurved when dry; inner deeply divided without intermediate cilia; leaf-cells narrow above, elongated, broad at the base, and especially at the angles.

1. *P. latebricola*, *Berk.*; stem slender, ascending, sparingly branched; leaves ovato-lanceolate, tapering, subsecund, entire, faintly two-nerved at the base; margin slightly reflected; sporangium elliptic-oblong, tapering below, erect; lid conical.—*Hook. & Wils. t. liv.*

On moist shady rocks, on decaying alder-stumps and old *Aspidium Filix-mas*. Cheshire, Lancashire, and Sussex. Bearing fruit in winter.

Dioicous; forming yellowish or bright-green shining tufts. Branches slightly flattened; leaf-cells narrow, broader at the base; inner peristome without intermediate cilia.

This is referred by Schimper to *Plagiothecium*, but the erect sporangium and absence of intermediate cilia forbid the association. It differs from *Leskea* in the nature of the leaves, which differ again from those of *Orthothecium*, with which it might otherwise have been classed.

22. **MYRINIA**, *Schimp.*

Sporangium symmetrical or slightly curved; ring none; peristome double, small; inner peristome without intermediate cilia, firm, coloured; leaf-cells rhomboid, quadrate at the angles; paraphylla none.

1. *M. pulvinata*, *Schimp.*; stem irregularly divided, procumbent; divisions slender, erect; leaves ovato-lanceolate, entire, loosely reticulated, with two nerves, or one reaching halfway;

sporangium elliptic-oblong; lid conical, apiculate.—*Hook. & Wils. t. liv.*

At the roots of trees near water. Yorkshire and Lancashire. Bearing fruit in early summer.

Monoicous; forming little, soft, deep-green cushions. Stems densely crowded; leaves spreading, with a short simple or forked nerve; cells large, angular, with a distinct primordial utricle; fruitstalk  $\frac{1}{3}$  inch high; sporangium oval-oblong, tapering below; lid conical, soon falling off; inner peristome reddish-brown.

Differs from *Leskea* in the reticulation and the nature of the inner peristome.

### 23. PTERIGYNANDRUM, *Hedw.*

Sporangium symmetrical; peristome double; outer of sixteen short teeth; inner an irregular very short membrane, with sixteen short processes more or less adherent to the outer teeth; rhizoma creeping; branches and branchlets secund; leaf-cells rhomboid, except at the angles, where they are quadrate.

1. *P. filiforme*, *Hedw.*; branches of secondary stem filiform, incurved, fasciculate; leaves subsecund, ovate, acuminate, two-nerved or with a single nerve reaching halfway; sporangium elliptic, oblong; lid rostrate.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 2297 in part, 2526.*; (*Moug. & Nest. n. 210.*)

On rocks and trunks of trees, especially beech, in mountainous districts. Bearing fruit, but rarely, in spring.

Dioicous; forming broad, green tufts. Branches and branchlets arcuate, leaning one way, more or less attenuated, somewhat fasciculate; leaves crowded, sometimes spreading, often secund, imbricated when dry, papillose, ovate, slightly attenuated, serrate above with a single nerve reaching halfway,

or a short double nerve; margin recurved; leaf-cells transparent; fruitstalk not an inch long, reddish; sporangium oblong; lid obliquely rostrate.

The genus differs from *Pterogonium* in the less dendroid habit, in the leaves being papillose, and their cells approaching nearer to those of *Hypnum*.

2. *Leaf-cells, at least those of the margin, roundish or elliptic, with thick walls.*

#### 24. ANTITRICHIA, *Brid.*

Sporangium oval, symmetrical, on a short curved stalk; peristome double; outer of sixteen teeth; inner of sixteen delicate filiform processes alternating with those of the outer peristome, united at the base by a narrow membrane, more or less adherent; leaf-cells on the margin elliptic, those of the disk a n base narrow.

1. *A. curtispindula*, *Brid.*—*Hook. & Wils. t. xxii.*; *Eng. Bot. t. 1444.*; (Plate 13, fig. 4); *Moug. & Nest. n. 47.*

On rocks and trees. Principally in mountainous countries. Bearing fruit in spring.

Dioicous. Stem several inches long, straggling, procumbent; branches yellowish-green, simple or subpinnate; branchlets often elongated, curved and flagelliform; leaves ovate, attenuated at the tip into a hair-like serrated point, the apex of which is bifid or trifid; nerve slender, reaching above the middle, sometimes forked or trifid; cells at the margin and towards the tip elliptic, elongated and narrow on the disk and at the base; fruitstalk shortly curved above, so as to make the sporangium pendulous; lid obliquely rostrate; peristome pale; spores large, yellowish.

There is a variety with shorter, straight fruitstalks, a

cylindrical sporangium, and shorter, more densely leafy stems, which has been found in Sussex by Mr. Mitten.

### 25. **THAMNIUM**, *Schimp.*

Sporangium symmetrical or slightly unsymmetrical, horizontal or cernuous; peristome double, the inner with or without intermediate cilia; primary stem (rhizoma) ereeping, secondary erect, dendroid; leaf-cells above rounded, those of the base more elongated.—Distinguished from *Hypnum* by its very peculiar habit, in which it agrees with *Climacium*. There are many exotic species, some of which could not be placed in *Isothecium*, with which the only British species has been associated more from convenience than conviction.

1. **T. alopecurum**, *Br. & Sch.*; secondary stem nearly naked below, pinnate above with frequently pinnate somewhat complanate branches; leaves spreading, ovato-lanceolate, sharply toothed; nerve reaching nearly to the apex; sporangium ovate, more or less inclined; lid rostrate.—*Hook. & Wils. t. xxv.*; *Eng. Bot. t. 1182.*; (Plate 13, fig. 1); *Moug. & Nest. n. 144.*

In moist shady woods and on rocks. Common. Bearing fruit in winter and spring.

Dioicous. Rhizoma throwing out many radicles; secondary stem 2 or 3 inches high, clothed below with minute, scattered, scale-like, pale, ovate, acuminate leaves, distichously pinnate above as are the branches, which are often curved; leaves more or less complanate, opaque, ovate or ovato-lanceolate, pointed, but scarcely acuminate, sharply toothed; nerve strong, vanishing below the apex; cells in the upper part of the leaf short, rounded, or subquadrate, more elongated at the base, and at the slightly reflected angles; fruitstalk scarcely an inch long, reddish, even; sporangia more or less aggregate, ovate,

more or less inclined, subsymmetrical; lid obliquely rostrate. The reticulation is quite different from that of any *Hypnum*.

## 26. LEUCODON, *Schwæg.*

Sporangium erect, symmetrical; peristome erect, single, of sixteen entire, perforated, or bifid teeth; leaf-cells of margin subrotund, of disk, elongated, disposed in lines; secondary stems erect, with descending stolons at the base.

1. *L. sciuroides*, *Schwæg.*; leaves crowded, densely imbricated, erect when dry, spreading when moist, ovato-lanceolate, acuminate, entire, plicate, nerveless; sporangium elliptic or oblong; lid conical, acute; teeth of peristome perforated.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 1903.*; (Plate 13, fig. 3); *Moug. & Nest. n. 321.*

On trunks of trees, walls, etc. Bearing fruit in spring.

Dioicous; forming bright-green tufts. Stem creeping, throwing up erect shoots, 2–3 inches long, often beset with axillary buds, thickened at the end and incurved, rarely divided; leaves closely imbricated, erect when dry, spreading when moist, and more or less secund, ovato-lanceolate, but varying greatly in breadth, strongly acuminate, entire, nerveless, plicate; cells at edge round, more oblong in the centre, disposed in rows; fruitstalk  $\frac{1}{2}$  an inch long; sporangium erect; lid conical, acute; teeth nearly white, more or less perforated; ring soon breaking up.

2. *L. Lagurus*, *Hook.*; stem irregularly branched, tomentose; leaves without striæ, ovato-oblong, concave, suddenly acuminate or piliferous, serrulate above, nerved halfway; sporangium erect, cylindrical; lid conical, with a short beak.—*Hook. Musc. Ex. t. 126.*

Var.  $\beta$ , *borealis*; stem not tomentose; branches tumid; leaves auriculate and serrated at the base, more concave, more

suddenly attenuated, with longer points, faintly 2-nerved at the base.—*Hook. & Wils. t.* lxi.

On rocks and trees. Var.  $\beta$  in North-West Hebrides, Dr. C. Smith. Not yet found in fruit.

The above is copied from the 'Bryologia Britannica.' Schimper proposes a new genus for it (*Myurium*), though ignorant of its fruit. If, however, it should ultimately prove to belong to a distinct genus, it should bear Wilson's name of *Lampurus*. Whether it is really identical with the Antarctic species is, for the present, uncertain. The narrow oblongo-rhomboid cells seem to indicate a genus different from *Leucodon*.

## 27. ANOMODON, *Hook. & Tayl.*

Sporangium symmetrical; peristome double; outer of sixteen teeth; inner of sixteen irregular fugacious processes alternating with those of the outer peristome, and connected at the base by an obscure membrane; veil naked, cuculliform; branches simple or irregularly divided; leaf-cells small, elliptic, or orbicular.

1. *A. viticulosus*, *Hook. & Tayl.*; sparingly branched; leaves subsecund, crisped when dry, ovato-lingulate, obtuse; nerve reaching nearly to the tip; fruitstalk slender, elongated; sporangium erect, subcylindrical; lid conical, acute.—*Hook. & Wils. t.* xxii.; *Eng. Bot. t.* 265.; (Plate 13, fig. 6); *Moug. & Nest. n.* 237.

On rocks, walls, and trees, chiefly in calcareous districts. Bearing fruit, but rarely, in winter.

Dioicous; forming broad, bright-green patches, which are ochraceous below. Rhizoma creeping, nearly simple; secondary stems erect, simple, or slightly divided; leaves more or less secund, ovate, narrowed above, and tongue-shaped,

rather obtuse, minutely toothed at the apex; margin rather waved; nerve reaching nearly to the tip; leaf-cells minute, elliptic, opaque; fruitstalk above  $\frac{1}{2}$  an inch long, yellowish; sporangium subcylindrical, erect; lid narrow, conical, acute; inner peristome very brittle; spores small, brown.

2. *A. longifolius*, *Hartm.*; branches slender, elongated; branchlets fasciculate; leaves subsecund, ovato-lanceolate, acuminate; nerve reaching to the tip; fruitstalk short; sporangium erect, oblong; lid conical, acute.—*Hook. & Wils. t. liv.*; (*Moug. & Nest. n. 1230.*)

On rocks. Scotland. Rare. Bearing fruit on the Continent in autumn and spring.

Dioicous; tufted, verdigris-green, when young yellowish, when old reddish below. Branches or secondary stems erect, slender, elongated with fasciculate often flagelliform branches; leaves subsecund, ovato-lanceolate, strongly acuminate, sulcate at the base; nerve reaching to the tip; leaf-cells roundish, minute; fruitstalk not  $\frac{1}{2}$  an inch long; sporangium oblong, subcylindrical; lid narrow, conical or rostellate.

A much more delicate species than the last, and resembling *Pseudoleskea catenulata* and *atrovirens*.

## 28. PTEROGONIUM, *Swartz.*

Sporangium symmetrical; peristome double; outer of sixteen teeth; inner of a short membrane, divided above into sixteen teeth, and more or less adherent to the outer; secondary stems dendroid; leaves even, not papillose; leaf-cells minute, subelliptic, longer in the disk towards the base.

1. *P. gracile*, *Sw.*; secondary stems arcuate; branches incurved, fasciculate; leaves imbricated, ovate, acute, two-nerved, serrated above; sporangium oblong; lid conical, acute.—



*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1085.*; (*Moug. & Nest. n. 817.*)

On rocks, walls, and trunks of trees, in subalpine districts. Bearing fruit in November.

Dioicous. Primary stem or rhizoma creeping, secondary suberect, dendroid, nearly naked below; branchlets arcuate, filiform; leaves closely imbricated, ovate, acute, serrated above, not papillose, two-nerved at the base; leaf-cells at the angles minute, gradually increasing in size upwards, where they are obliquely elliptic and subrhomboid, longer and narrow towards the centre of the base, and occasionally at the very apex; fruitstalk  $\frac{1}{2}$  an inch long, red; sporangium subcylindrical; lid shortly rostellate.

### 29. LESKEA, *Hedw.*

Sporangium erect, symmetrical; peristome double; cilia of inner peristome wanting or abortive; leaf-cells roundish, papillose, with thick cell-walls.

1. *L. polycarpa*, *Ehr.*; stem creeping, more or less divided; branches often irregularly pinnate, suberect, slightly curved and thickened at the end; leaves spreading or subsecund, imbricated, ovate, pointed; nerve reaching almost to the tip; sporangium erect, subcylindrical; lid conical.—*Hook. & Wils. t. xxiv.*; *Eng. Bot. t. 1922.*; (*Moug. & Nest. n. 224.*)

At the roots of trees and stones, especially near water. Fruiting in early summer.

Monoicous; forming yellowish or dull-green intricate tufts. Stem slender, creeping or procumbent, more or less divided; branches irregularly pinnate or slightly divided; divisions swollen at the tip; leaves spreading or subsecund, ovato-lanceolate, concave, attenuated but not acuminate, ending obtusely with a strong nerve running nearly to the tip; cells

roundish, slightly papillose at the back; margin reflected below, entire; fruitstalk  $\frac{1}{2}$  an inch long; sporangium sub-cylindrical; lid conical, more or less acute; outer teeth incurved when dry, so as to assume the form of a staple; inner peristome with intermediate cilia.

A variety grows in very moist shady places with lax, distant, widely-spreading, dull-green leaves and a more elongated sporangium, which was formerly esteemed a good species, but Schimper now follows Wilson in not considering it distinct.

### 30. LEPTODON, *Brid.*

Sporangium symmetrical; outer peristome of sixteen teeth, inner a short jagged membrane; leaf-cells round; veil hairy, cuculliform; branches pinnate or bipinnate.

1. **L. Smithii**, *Brid.*; stems creeping; branches pinnate and bipinnate; branchlets elongated, strongly incurved when dry; leaves roundish, very obtuse, entire; margin recurved below; nerve reaching above the middle; fruitstalk short; lid rostrate.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1326.*; (Plate 13, fig. 5.)

On trunks of trees in the south of England. Bearing fruit in spring.

Dioicous. Stem or rhizoma creeping; branches crowded, pinnate or bipinnate, strongly or even spirally incurved when dry; branchlets often elongated, flagelliform; leaves mostly deep-green, broadly elliptic, very obtuse, entire; nerve reaching beyond the middle; leaf-cells nearly orbicular, arranged in longitudinal or transverse lines; leaves of the flagelliform shoots minute, nerveless; perichæatial leaves almost as long as the fruitstalk; vaginula hairy; sporangium elliptic; teeth of the peristome pale; lid obliquely rostrate; veil hairy; spores rather large, greenish.

Very different in habit from any other British Moss.

ORDER VII. *ANÆCTANGIEI*, Br. & Schimp.

Sporangium erect, oval or spherical, with a small persistent annulus, but entirely free from peristome; vaginula perfect and not more or less blended with the original receptacle or partially immersed below the point of insertion of the uppermost perichæatial leaves; leaf-cells small, quadrate.

31. *ANÆCTANGIUM*, Br. & Schimp.

Sporangium oval, with a slight apophysis; peristome wanting.

1. *A. compactum*, Schwæg.; densely tufted; stem slender; leaves lanceolate, slightly toothed below; sporangium small, ovato-oblong; lid obliquely rostrate.—*Hook. & Wils. t. vi.; Eng. Bot. t. 2201.*; (Plate 14, fig. 1.)

In the crevices of alpine rocks, especially near waterfalls. Bearing fruit in autumn.

Dioicous; forming dense tufts, bright-green above, ferruginous below. Stems 2 to 3 inches long, slender, forked; leaves imbricated, crisped and spirally directed when dry, ovato-oblong or lanceolate, entire above, slightly toothed below; nerve strong, reddish, reaching to the apex; leaf-cells minute, rectangular or quadrate, arranged in lines, scarcely altered at the base; fruitstalk  $\frac{1}{2}$  an inch long; sporangium small, ovate, contracted at the mouth with a slight swelling below; lid obliquely rostrate, nearly as long; veil cuculliform, obliquely subulate.

The genus is altogether anomalous, and, on account of its dichotomous stems and the structure of the leaves, is placed by Schimper near *Weissia*.

The other supposed British species, *A. Hornschuchianum*, said to be found by Dr. Taylor at Killarney, is very doubtful, and therefore omitted.

**B. CLADOCARPI.** *Sporangium borne on short lateral branches ; vaginula perfect.*

#### ORDER VIII. *DREPANOPHYLLEI*, Mont.

Stems flat ; leaves distichous, equitant ; sporangium symmetrical, stalked, either lateral or terminal ; vaginula perfect ; peristome single, of sixteen bifid teeth ; veil mostly euculliform.

The sporangium in this Order is not truly pleurocarpous, but rather seated at the tip of a very short lateral branch, except in the cases where it is terminal. It forms an exact transition from the Pleurocarpous to the Aerocarpous Mosses. Some of the exotic species of this group are amongst the most beautiful of the class.

#### 32. *FISSIDENS*, Hedw.

Sporangium terminal or cladocarpous, on a long stalk, erect or cernuous, symmetrical ; veil euculliform or more rarely mitriform ; peristome single, of sixteen equidistant teeth, cloven halfway down ; stems frond-like, compressed ; leaf-cells roundish, subhexagonal.

##### 1. *Sporangium lateral.*

1. *F. adiantoides*, Hedw. ; monoicous ; stem elongated, branched ; leaves crowded, oblong, suddenly acuminate, toothed above, slightly toothed below ; nerve reaching to the tip ; fruitstalk rather long, lateral ; sporangium cernuous ; lid rostrate.—*Hook. & Wils. t. xvi. ; Eng. Bot. t. 264. ;* (Plate 14, fig. 2) ; *Moug. & Nest. n. 25.*

On the ground in shady places, on wet rocks, or in pastures or bogs. Bearing fruit in winter.

Stem 1–2 inches high, slightly branched, rooting at the base of the innovations; leaves flat, equitant, oblong, pointed above and toothed, more minutely toothed below, rounded behind at the base; nerve strong, reaching to the tip; dorsal wing, an expansion of the nerve, broad; leaf-cells minute, seriate; sporangium produced near the tip of the branches; fruitstalk  $\frac{1}{2}$ –1 inch long; lid rostrate; veil cuculliform; teeth sometimes adhering at the tips; golden-yellow, with red bars.

Distinguished at once from the next by the different position of the fruit, and by the leaves being more curled when dry.

2. *F. taxifolius*, *Hedw.*; monoicous, branched in a fasciculate manner from the base; leaves crowded, lanceolate, mucronate; margin finely crenulate; fruitstalks radical, rather long; sporangium oblong, cernuous; lid rostrate.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 426.*; (Plate 14, fig. 3); *Moug. & Nest. n. 217.*

On clayey banks in woods, etc. Bearing fruit in autumn.

Shorter than the last, and more delicate. Branches springing up from the base in fascicles, bright-green; leaves lanceolate, rounded at the base on either side, mucronate, but little crisped when dry, rather crenulate than toothed, ovato-lanceolate; nerve reaching to the tip; fruitstalks  $\frac{1}{2}$  an inch or more long, flexuous; sporangium oblong; lid rostrate.

3. *F. tamarindifolius*, *Donn*; monoicous; stems fasciculate; leaves short, distant, spreading, narrowly elliptic, sub-falciform, apiculate, bordered, entire; crisped or undulated when dry; fruit from the base of the barren shoots; sporangium ovate, curved, cernuous; lid conical, acuminate; male flower at the base of the fertile stem.—*Hook. & Wils. t. liii.*

On banks and in fallow ground, from Scotland to Sussex, occasionally. Bearing fruit in spring.

The above character is copied almost verbally from the 'Bryologia Britannica.' Schimper considers the species to be identical with *F. incurvus*; but that, according to Wilson, is smaller, has longer and narrower leaves, and of a less firm texture, as also it differs in the presence of barren fronds and in the fasciculate habit, the fruit being sometimes axillary, sometimes radical.

## 2. *Fruit terminal.*

4. **F. polyphyllus**, *Wils.*; stem much elongated, simple or slightly branched; branches arcuate; leaves crowded, erecto-patent, oblong, acute, serrated above; nerve reaching to the apex; dorsal lamina not decurrent; male flowers numerous, axillary.—*Hook. & Wils. t. liii.*

On moist shady rocks in mountainous districts. Ireland and Wales. Fruit unknown.

Probably dioicous. Stems several inches or even a foot long, slightly branched; leaves glossy, not crisped when dry, entire below.

Schimper considers this distinct from *F. asplenioides*, and the texture and size of the leaves seem to indicate a specific distinction. Mr. Wilson, however, now believes that it is the male plant of *F. serrulatus*, Brid. (Ap. 7, 1863.)

5. **F. osmundioides**, *Hedw.*; dioicous; densely tufted; stem repeatedly dichotomous; leaves ligulate, not margined, minutely toothed; nerve not reaching to the apex; sporangium oval-oblong; lid rostrate; veil many-lobed.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 1662.*

On wet rocks and amongst peat in alpine or subalpine districts. Bearing fruit in summer.

Densely tufted, dark-green. Stems 1–2 inches long, re-

peatedly forked, matted together with rootlets; lower leaves distant, small, upper larger, crowded, oblong or scalpel-shaped, obtuse, with a little point, firm, incurved when dry, finely toothed; dorsal wing not decurrent; nerve strong, ceasing below the apex; fruitstalk terminal, rather short, reddish; lid rostrate; veil split at the base into several lobes scarcely cuculliform; sporangium oval-oblong, erect or somewhat inclined.

6. *F. bryoides*, *Hedw.*; monoicous; stems short, subcæspitose; leaves widely lanceolate, apiculate, border cartilaginous; nerve reaching to the tip and confluent with the border; sporangium erect, oval or oblong; lid acuminate; male flowers axillary.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 625.*

On shady banks. Common. Bearing fruit in winter.

Stems very short, forming little tufts or scattered; leaves rather distant, somewhat lingulate, apiculate with a distinct border, crisp when dry; dorsal lamina broad at the base; fruitstalk longer than the stem, red; sporangium elliptic, mostly erect; lid acuminate; veil cuculliform.

Differs from the following in the numerous axillary male flowers and the narrow base of the dorsal lamina.

7. *F. viridulus*, *Wahl.*; monoicous; stem simple, assurgent; leaves lanceolate, bordered, apiculate; dorsal lamina ending above the base; sporangium erect, oval-oblong; lid acuminate; male flower terminal.—*Hook. & Wils. t. liii.*; (*Moug. & Nest. n. 216.*)

On shady ground, especially where sandy, sandstone rock, etc. Bearing fruit in autumn.

Gregarious, inclined or decumbent. Stems short; leaves more or less crowded, lanceolate, strongly bordered, with the dorsal wing attenuated below and ending above the base; nerve reaching to the apex; fruitstalk as long or longer than

the stem; sporangium erect and symmetrical; lid acuminate.

A large variety occurs in sluices, and one not yet found in this country, *S. fontanus* (*Moug. & Nest. n.* 1116), is an inch or an inch and a half long, and occurs on the walls of wells or in the water itself.

8. *F. incurvus*, *Schwæg.*; monoicous; stem slender, assurgent; leaves spreading, bordered, elongated, apiculate; nerve subexcurrent; sporangium oblong, curved, cernuous; male flowers sessile at the base of the stem.—*Hook. & Wils. t.* liii.; *Eng. Bot. t.* 1368, *description only*; (*Moug. & Nest. n.* 823.)

On banks and in pastures. Bearing fruit in spring.

This seems really to be a good species, differing in the position of the male flowers, inclination of the sporangium, and time of flowering.

9. *F. exilis*, *Hedw.*; monoicous. Stems very short; leaves few, obliquely lanceolate, not bordered, minutely toothed; dorsal wing ceasing above the base; sporangium erect, oblongo-elliptic; lid obliquely rostrate.—*Hook. & Wils. t.* liii.; *Eng. Bot. t.* 1368; *Lond. Journ. of Bot.* 1845, *t.* 9.

On shady banks in woods. England, Scotland, and Ireland. Flowering in early spring.

Extremely small. Stems very short, nearly erect; leaves from four to six, lanceolate, acute or apiculate, finely toothed; nerve strong, ceasing near the apex or excurrent; fruitstalks short, terminal; sporangium erect; lid as long as the sporangium; male flower at the base of fertile stem. Easily distinguished by the absence of the border to the leaves.

#### ORDER IX. *MIELICHOFERIEI*, Br. & Schimp.

Sporangium with or without an apophysis; peristome simple or double; when simple, of sixteen narrow teeth united by a



basal membrane; fruitstalk lateral (cladocarpous); vaginula perfect.

### 33. MIELICHOFERIA, *Nees & Hornsch.*

Cladocarpous. Sporangium pyriform or clavate; peristome simple, of sixteen teeth, confluent at their dilated base, narrow above, occasionally perforated below; veil cuculliform.

1. *M. nitida*, *Hornsch.*; leaves erecto-patent, larger and more crowded above, ovato-lanceolate, serrated above; sporangium suberect, pyriform; lid conical, very short.—*Hook. & Wils. t. lxi.*; *Hook. Musc. Ex. t. 101.*

On moist rocks. Found in a barren state only by Dr. Greville, at the head of Glen Callater. Bearing fruit in August and September.

The British specimens belong to the var. *β. gracilis*, which has densely tufted stems, shorter and more crowded imbricated leaves, and an erect sporangium.

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## FAMILY II.—ACROCARPI.

Fruit terminal.

### ORDER X. SCHISTOSTEGEI, Br. & Schimp.

Sporangium subglobose; peristome wanting; veil hood-shaped or mitriform; spore-sac adnate with the walls of the sporangium; lid convex; spores radiating; leaves distichous, free at the base or confluent; leaf-cells large; rhizoma perennial.

### 34. SCHISTOSTEGA, *Mohr.*

Characters those of the Order.

1. *S. osmundacea*, *Web. & Mohr.*—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 2213.*; (Plate 14, fig. 4); *Moug. & Nest. n. 1013.*

Moist banks and sandstone caves. In several parts of England, but local. Abundant near Nottingham, on the Mansfield road. Bearing fruit in spring.

Dioicous; rhizoma creeping. Stem very short, nearly naked below; leaves distichous, vertical, elliptico-rhomboid; cells large; fruitstalk terminal; vaginula leafy below; veil variable, rather ragged at the base, brownish at the tip, fugacious; lid convex, not really splitting up except when compressed.

A most lovely little Moss, sometimes illuminating the caves where it grows with a golden light, from the refraction of its young succulent confervoid threads.

#### ORDER XI. *SPLACHNEI*, Br. & Schimp.

Sporangium straight, furnished at the base with an apophysis often of greater diameter than itself; spores mostly radiating; leaves diaphanous, large-celled. *Mosses mostly springing from decayed wood, vegetables, or dung.*

#### 35. *ÆDIPEDIUM*, Schwæg.

Sporangium subclavate, confluent with the apophysis and fruitstalk; peristome wanting; spore-sac globular, contiguous to the walls of the sporangium; veil hood-shaped, fugacious; lid convex; leaf-cells roundish.

1. *Æ. Griffithianum*, Schwæg.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 1938.*; (Plate 14, *f. 5.*)

In crevices of rocks on our higher mountains. Bearing fruit in summer. Not known as a native of the Continent, except in Norway.

Forming little pale tufts. Stem very short, except when gemmiferous; leaves obovate, waved, narrow at the base, with branched rootlets springing from it behind; nerve very strong, ending abruptly about halfway up; leaf-cells roundish, sub-hexagonal, more elongated towards the base.

36. DISSODON, *Grev. & Arn.*

Sporangium with a long, solid, tapering apophysis; columella retracted, mostly exerted when dry; peristome of sixteen short double-teeth, slightly incurved (not reflexed) when dry. *Terrestrial Mosses, with obtuse entire leaves.*

1. **D. Frœlichianus**, *Grev. & Arn.*; gregarious or tufted; leaves ovato-oblong, sublingulate; nerve reaching nearly to the tip; sporangium with the apophysis clavato-pyriform; lid conical; teeth in pairs; columella not exerted.—*Hook. & Wils. t. ix.*; *Eng. Bot. t. 2507.*

Said to have been found by Dickson in Aberdeenshire. Bearing fruit in summer.

Synœious or polygamous. Stems short; leaves loosely imbricated, green, shining; sporangium clavato-pyriform, neck or apophysis confluent with it but shorter; columella not exerted when dry; teeth sixteen in eight pairs, each marked with a medial line; spores large, papillose, brownish.

Dickson's plant was probably nothing more than a state of the next.

2. **D. splachnoides**, *Grev. & Arn.*; leaves erecto-patent, lingulate, obtuse; nerve reaching nearly to the apex; sporangium obovate, tapering below; peristome of sixteen equidistant teeth; columella exerted.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 2095*; *Grev. Sc. Crypt. Fl. t. 145.*; (Plate 14, fig. 6.)

In wet turfy bogs on high mountains in Scotland. Bearing fruit in summer.

Forming dense, dark-green, tall, fastigiate tufts, blackish below. Stems dichotomous, clothed with dark rootlets below; leaves obovato-oblong or lingulate; sporangium with the swollen apophysis oval, erect, or sometimes oblique; lid conical, remaining attached a long time to the exerted columella;

teeth sixteen, marked with a medial line, equidistant; spores much smaller than in the last species, greenish, papillose.

### 37. TAYLORIA, *Hook.*

Sporangium with a narrow clavate or subpyriform apophysis; teeth sixteen or thirty-two, inserted below the orifice, reflexed when dry and sometimes curled; spores small. *Mosses growing on decayed animal or vegetable substances.*

1. *Tayloria serrata*, *Br. & Schimp.*; leaves oblongo-obovate, acuminate, serrated; nerve reaching nearly to the tip; sporangium shorter than the oblong apophysis; lid obtuse.

$\gamma$ . *tenuis*; leaves broader, less acuminate; apophysis more slender; columella more exerted.—*Hook. & Wils. t. ix.*; *Eng. Bot. t. 1133.*; (Plate 14, fig. 7); *Moug. & Nest. n. 1104.*

On Scotch mountains, the variety  $\gamma$  only. Bearing fruit in summer.

Monoicous; forming irregular, bright-green tufts. Stem radiculose; innovations about an inch long, erect; teeth linear-lanceolate, when moist incurved, when dry reflexed, red tinged with yellow.

### 38. TETRAPLODON, *Br. & Schimp.*

Sporangium subcylindrical with a clavate or oval apophysis; fruitstalk solid; peristome single, of sixteen double teeth, at first approximated in fours, and at length in pairs, reflexed when dry; veil hood-shaped. *Mosses growing on animal substances or the dung of carnivorous animals.*

1. *T. angustatus*, *Br. & Schimp.*; stems slender, tufted, subdivided; leaves elongato-lanceolate, hair-pointed, serrated; nerve reaching to the tip; apophysis obconical; fruitstalk short.—*Hook. & Wils. t. ix.*; *Eng. Bot. t. 1132.*; (Plate 15, fig. 1); *Sommerf. n. 8.*

On dung and other animal substances on high Scottish mountains. Bearing fruit in summer.

Monoicous; forming tufts varying much in depth. Leaves slightly concave; nerve strong, running into the hair-point; fruitstalk short, apophysis obconical, rather narrower than the sporangium; teeth reflected together in fours, reddish-brown.

2. *T. mnioides*, *Br. & Schimp.*; stems densely tufted; leaves very concave, oblongo-elliptic, extremely attenuated above, nearly entire; nerve reaching to the tip; apophysis obovate, slightly wider than the sporangium; fruitstalk elongated; teeth in eight pairs.—*Hook. & Wils. t. ix.*; *Eng. Bot. t. 786*, 1589, 2417.; (Plate 15, fig. 2); *Sommerf. n. 9*.

On dung or decayed animal substances on high mountains in England, Scotland, Ireland, and Wales. Bearing fruit in May.

Monoicous. Tufts sometimes 3 inches long; leaves more or less erect, elliptic or obovate, elongated with an acuminate hair-like point, very concave; sporangium oval; teeth yellowish below, red above, collected in pairs.

### 39. SPLACHNUM, L.

Sporangium quite distinct from the large spongy apophysis, which increases in size after the fruit is ripe; veil minute, conical, entire or lacerated at the base; peristome simple; teeth sixteen, disposed in pairs, reflexed when dry; spores small. *Annual or perennial, loosely-tufted Mosses, growing on dung of herbivorous animals.*

1. *S. sphæricum*, *Hedw.*; dioicous; leaves obovate from a narrow base, acuminate, entire or slightly toothed; sporangium broadly oval or subglobose; apophysis subglobose, dark-red; lid mammillary; teeth of peristome rather large.—*Hook.*

& *Wils. t.* ix.; *Eng. Bot. t.* 785, 1590, 1921.; (Plate 15, fig. 3); *Moug. & Nest. n.* 1103.

On dung in alpine bogs. Bearing fruit in early summer.

Forming loose tufts. Stems mostly short; lower leaves small, upper spreading, narrow at the base, obovate, acuminate, entire or strongly toothed; nerve reaching nearly to the tip; fruit-stalk extremely variable in length, even in the same plant; sporangium elliptic or subglobose; apophysis globose or ovate; teeth yellowish, at length separate.

2. *S. ampullaceum*, *L.*; leaves lanceolate, upper obovate or oblongo-lanceolate, acuminate, toothed; nerve reaching nearly to the tip; sporangium oblong; apophysis large, pitcher-shaped; lid conical.—*Hook. & Wils. t.* ix.; *Eng. Bot. t.* 144, 1116.; (Plate 15, fig. 4); *Moug. & Nest. n.* 15.

In turbaries, on dung of herbivorous animals, on the plains or in subalpine districts. Bearing fruit in early summer.

Monoicous or dioicous; forming pale-green loosely or sometimes densely tufted patches, which in drying emit an odour like tanned leather. Stem varying in length, annual or biennial, often matted together by brown rootlets; sporangium ovato-cylindrical, yellowish with a large soft pear-shaped flesh-coloured apophysis, which at length assumes a purple tint, gradually attenuated below and confluent with the long stem, the central substance connected with the outer by threads which traverse a considerable cavity.

*S. Turnerianum*, *Eng. Bot.*, is a variety with very short stems, darker leaves, and much narrower apophysis, more nearly resembling *S. sphaericum*. I have received it from Devonshire.

3. *S. vasculosum*, *L.*; dioicous; stems elongated; leaves large, lower suborbicular, upper obovate, somewhat acuminate, nearly entire; nerve reaching nearly to the tip; sporan-

gium cylindrical; apophysis large, globose, tuberculated, purple.—*Hook. & Wils. t. xxxi.*; *Grev. Sc. Crypt. Fl. t. 179, 311*; *Eng. Bot. t. 2094.*; (Plate 15, fig. 5.)

On the Scottish mountains, in wet places near springs. Bearing fruit in summer.

Annual biennial or perennial, forming soft deep-green tufts; sometimes dingy-green and less tufted. Stem elongated, clothed with purple rootlets below; leaves pointed, acute or obtuse; fruitstalk reddish; sporangium cylindrical, rufous, with a large globose dark-purple apophysis, which is minutely tuberculated when fresh, rugose when dry.

One of our finest and most interesting Mosses.

#### ORDER XII. DISCELIEI, Br. & Schimp.

Sporangium subglobose, eernuous; ring large; teeth sixteen, cloven at the base; veil twisted. *Annual, nearly stemless Mosses, with confervoid rootlets.*

#### 40. DISCELIUM, *Brid.*

Characters those of the Order.

1. *D. nudum*, *Brid.*—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1421.*; (Plate 15, fig. 6.)

On clay banks. Scotland and north of England, especially about Manchester. Bearing fruit in early spring.

Dioicous; plants scattered on a confervoid stratum. Leaves few, imbricated, ovato-lanceolate, entire, large-celled, reddish; fruitstalk twisted when dry, about an inch long; sporangium globose, rather eernuous; lid conical, more or less acute; veil split on one side, twisted, often entire at the base and adhering to the fruitstalk.

This Moss combines the habit of *Phascum* with the sporangium of *Catoscopium* and the teeth of *Trematodon*.

ORDER XIII. *OREADEI*, Br. & Schimp.

Sporangium small, subglobose, cernuous; peristome single or with traces of an inner peristome; veil hood-shaped.

41. *CATOSCOPIUM*, *Brid.*

Sporangium shining, even, subcorneous, cernuous; ring none; peristome of sixteen short, lanceolate or truncate teeth, with occasional traces of an inner membrane. *Perennial marsh Mosses.*

1. *C. nigratum*, *Brid.*—*Hook. & Wils. t.* xiv.; *Eng. Bot. t.* 1825.; (Plate 15, fig. 7); *Moug. & Nest. n.* 1106.

Moist rocks and marshes in alpine and subalpine districts. Scotland and north of England. Bearing fruit in summer.

Dioicous; forming soft dense, green, tufts. Stems slender, matted together below with rootlets, slightly divided; leaves erecto-patent, lanceolate, acuminate; nerve reaching to the tip, often reddish; margin reflected; leaf-cells elongated, not angular; fruitstalk shining-red,  $\frac{1}{2}$ –1 inch long; sporangium elongated, rectangular, subglobose, suddenly bent at the base, shining, even, chestnut-brown, then black; lid shortly conical; teeth short, irregular, with traces of an inner membrane; spores large, even.

Allied to *Meesia*.

ORDER XIV. *BARTRAMIEI*, Br. & Schimp.

Sporangium spherical, mostly striated; peristome variable; leaves rigid, lanceolate, keeled, denticulate. Perennial.

42. *CONOSTOMUM*, *Swartz.*

Sporangium subglobose, cernuous; ring none; veil hood-shaped, rather large; peristome of sixteen equidistant linear-lanceolate teeth united at their apices and forming a cone; spores large.



1. **C. boreale**, *Sw.*; densely tufted; leaves lanceolate, strongly acuminate, serrated; nerve excurrent; lid about half as long as the sporangium.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1135.*; (Plate 15, fig. 8); *Sommerf. n. 108.*

On the ground, at the tops of the Scottish alps. Bearing fruit in early autumn.

Dioicous; forming dense, fastigiata, rather glaucous tufts. Stems matted together by brown rootlets, more or less branched; leaves crowded in five rows so as to make the branches pentagonal, lanceolate, strongly acuminate; cells quadrate or rectangular; veil attached for a long time, hood-shaped; fruitstalk  $\frac{1}{2}$ –1 inch long; sporangium obovate, striate; spores large, brown, slightly granulated.

The peristome is a beautiful object under the microscope. The male flowers are subdiscoid.

#### 43. **BARTRAMIA**, *Hedw.*

Sporangium subglobose, sulcate when dry, erect cernuous or pendulous, inserted somewhat obliquely; veil small, hood-shaped, fugacious; peristome double, single, or wholly absent. *Perennial tufted Mosses, mostly with papillose leaves.*

1. **B. ithyphylla**, *Brid.*; synoicous; leaves erecto-patent from a sheathing base, lanceolato-subulate, rigid, toothed, straight when dry; nerve very strong and broad; sporangium oblique; inner peristome with imperfect processes.—*Hook. & Wils. t. xxiii.*; *Eng. Bot. t. 1710.*; (Plate 16, fig. 1); *Moug. & Nest. n. 622.*

On alpine and subalpine rocks. Bearing fruit in June.

Forming bright-green tufts. Stems dichotomous, fastigiata; leaves lanceolato-subulate above, spreading from a broad white or pale erect sheathing base; nerve very strong, occupying the greater part of the leaf; fruitstalk 1 inch long; sporan-

gium spherical, oblong and incurved when dry, deeply sulcate lid conical, blunt; teeth of outer peristome red, joined at the base by a pale membrane, horizontal when wet, and closing the orifice of the sporangium, sometimes perforated or split, inner teeth pink, about half as long as the outer, slender.

2. *B. pomiformis*, *Hedw.*; monoicous; stems dichotomous; branches fastigiata; leaves spreading, crisped when dry, linear-lanceolate, toothed; sporangium subglobose, cernuous.—*Hook. & Wils. t. xxiii.*; *Eng. Bot. t. 998.*; (Plate 16, fig. 2); *Moug. & Nest. n. 137.*

*β. crispa*; leaves less crowded; branches often longer than the fruitstalks.—*Eng. Bot. t. 1526.*; (*Moug. & Nest. n. 1026.*)

On dry shady banks, and in fissures of rocks in a sandy or granitic soil. Bearing fruit in early summer. *Feb. April*

Forming soft, glaucous or yellowish-green cushions. Stems matted below with rusty down; leaves erecto-patent, keeled, elongato-lanceolate, with a double row of serratures, not sheathing as in the last, scabrous; sporangium spherical, sulcate when dry; outer teeth longer than in the last, more regular, attenuated above and joined into a cone when moist as in *Conostomum*; inner peristome yellowish, shorter than the outer; spores strongly granulated.

3. *B. Halleriana*, *Hedw.*; monoicous; stems elongated; branches subfastigiata; leaves spreading, bristle-shaped, from a sheathing base, sharply toothed, somewhat crisped when dry; fruitstalk shorter than the leaves, slightly curved.—*Hook. & Wils. t. xxiii.*; *Eng. Bot. t. 997.*; (*Moug. & Nest. n. 35.*)

On alpine or subalpine rocks. Bearing fruit in summer.

Forming soft loose, bright-green tufts. Stems matted below with rusty rootlets; leaves spreading or subsecund; sheath whitish; fruitstalks very short, curved, single or gregarious, appearing lateral from the growth of innovations from the tip

of the branches; sporangium spherical; lid minute, convex; teeth of outer peristome dark-red.

4. *B. Œderi*, *Swartz*; synoicous; stems tall, more or less crowded; leaves spreading or recurved, lanceolate, keeled and toothed at the apex, even on either side, twisted when dry; sporangium small, oblique, globose.—*Hook. & Wils. t. xxiii.*; *Eng. Bot.* 1826.; (Plate 16, fig. 3); *Moug. & Nest. n. 326.*

On moist shady rocks in alpine or subalpine districts, especially when calcareous. Bearing fruit in summer.

Forming soft, dark-green patches, tinged with brown. Stems elongated, matted together with rusty rootlets; leaves narrow, lanceolate, spreading and recurved, not suddenly dilated at the base, even on either side, serrated, crisped when dry; margin recurved; nerve scarcely reaching beyond the tip; fruitstalk about  $\frac{1}{2}$  an inch long; sporangium small, globose, ovato-oblong and sulcate when dry; peristome like that of *B. pomiformis*.

In consequence of the absence of papillæ, the leaves are more transparent than in other species. The cells, too, are more regularly rectangular.

5. *B. rigida*, *Bals. & De Not.*; monoicous; stem very short; leaves crowded, erecto-patent, lanceolate, sharply toothed; nerve excurrent; sporangium obliquely cernuous; fruitstalk erect; lid conical.—*Hook. & Wils. t. lii.*

On mountainous shady banks. Ireland. Bearing fruit in summer.

Monoicous; forming little compact yellow-green tufts. Branches fasciculate; leaves rigid, shining; margin reflected, sharply toothed; fruitstalk elongated; teeth of peristome short, incurved when dry; inner peristome sometimes wanting or rudimentary; male fruit gemmiform.

This and the two following belong to Bridel's genus *Philo-*

*notis*, distinguished principally by the distinct cilia of the inner peristome, and in the dioicous species, by the male flowers being disciform, not gemmiform.

6. **B. fontana**, *Brid.*; stems elongated, simple or dichotomous; leaves dimorphous, the smaller ovate, acuminate, pressed to the stem, the larger erecto-patent or secund, ovato-lanceolate; male inflorescence discoid; sporangium cernuous, ovato-globose, thick; lid convex, conical.—*Hook. & Wils. t.* xxiii.; *Eng. Bot. t.* 390.; (*Moug. & Nest. n.* 36.)

In wet spots about springs, especially in alpine or subalpine districts. Bearing fruit in summer.

Dioicous; forming yellow-green or glaucous tufts of greater or less density. Stems simple or dichotomous, matted together with chestnut rootlets; branches often whorled; leaves variable in direction, obscurely plicate below, toothed; margin reflected; perigonal leaves obtuse, nerveless; fruitstalk an inch or more long, nearly straight, tough; sporangium curved and sulcate when dry; teeth of outer peristome closely barred; cilia of inner peristome (Plate 16, fig. 4 *d*) nearly as long as its teeth.

A very variable species, of which several distinct varieties are recorded, differing in the length of the stem, direction of branches, form and direction of leaves, size of sporangium, etc.

7. **B. calcarea**, *Br. & Schimp.*; dioicous; stems stout, elongated; leaves crowded, secund or falcato-secund, ovato-lanceolate; margin plane; teeth of outer peristome remotely barred.—*Hook. & Wils. t.* lii.; (Plate 16, fig. 4); *Moug. & Nest. n.* 1118.

In calcareous springs. Scotland and north of England. Bearing fruit in July.

Forming large, dense, green, not yellowish tufts. Leaf-cells large, elongated, subhexagonal, especially near the excurrent

nerve and towards the base, slightly papillose; margin reflected at the base only; perigonal leaves large, spreading, widely nerved to the apex, acuminate; sporangia large, ovato-globose or spherical; teeth of peristome rather short, with distant articulations.

8. *B. arcuata*, *Brid.*; dioicous; stem elongated; branches fasciculate or whorled; leaves squarrose, from a broad erect sheathing base, sharply toothed, sulcate, scabrous; fruitstalk arcuate; sporangium subpendulous.—*Hook. & Wils. t. xxiii.*; *Eng. Bot. t. 1237.*

On wet rocks. Scotland to Devonshire. Bearing fruit, but rarely, in autumn.

Forming large yellow-green patches. Stems densely clothed with rusty rootlets; leaves squarrose, lanceolate, from an ovate sheathing base; fruitstalk about  $\frac{1}{2}$  an inch long; sporangium subglobose, not so strongly sulcate when dry as in other species.

This species belongs to Bridel's genus *Breutelia*, characterized principally by its subpendulous sporangium.

#### 44. *BARTRAMIDULA*, *Br. & Schimp.*

Sporangium pendulous on a curved fruitstalk, globose, thin, soft, not striated; mouth small; peristome none; spore-sac united above with the columella. *Perennial.*

1. *B. Wilsoni*, *Br. & Schimp.*—*Eng. Bot. t. 2919.*

On loose, black, turfy soil. Ireland and Wales. Bearing fruit in October.

Synœious; forming loose low patches. Stems slightly decumbent below, branched; leaves ovate, acuminate, minutely toothed above; nerve reaching to the tip or excurrent; leaf-cells rather lax, oblong, slightly papillose; fruitstalk 3 or 4 lines high, arched above; sporangium subglobose or pear-

shaped, pendulous, reddish; spore-sac attached to the walls by threads; lid convex, obtuse; spores rough; veil hood-shaped, fugacious.

Not found at present on the Continent.

ORDER XV. *FUNARIEI*, Br. & Sch. (*Physcomitriei*, Schimp.)

Sporangium pyriform, straight or oblique, even or striate; peristome variable, sometimes wanting; veil inflated below, subulate above, vesicular, split at the base; leaf-cells large. *Annual or subbiennial Mosses.*

45. *PHYSCOMITRIUM*, *Brid.*

Veil not reaching beyond the middle of the sporangium, 5-6-lobed, furnished above with a long straight beak; peristome none.

1. *P. sphæricum*, *Br. & Schimp.*; monoicous; leaves spreading, ovate and spathulate, subacute, obscurely toothed; nerve vanishing below the tip; fruitstalk short; sporangium subglobose, wide-mouthed; lid large, conical.—*Hook. & Wils. t. lii.*; *Eng. Bot. t. 2830.*; (*Moug. & Nest. n. 708.*)

On dried mud of pools. Mere, Cheshire. Bearing fruit September, 1854. Not found elsewhere in Great Britain.

Forming more or less dense pale-green patches. Stems 1-3 lines high; leaves decurrent at the base, concave, somewhat rosulate above; leaf-cells large, equally or unequally hexagonal; fruitstalk about 2 lines high; lid mammillary; ring, according to Schimper, very narrow and breaking up, consisting of a single row of cells.

2. *P. pyriforme*, *Br. & Schimp.*; monoicous; stem slightly divided; lower leaves distant, ovato-lanceolate, upper spathulate erecto-patent, sharply toothed; nerve ceasing below the tip;

sporangium subpyriform; lid conical.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 413.*; (*Moug. & Nest. n. 13.*)

On moist banks, etc. Common. Bearing fruit in spring.

Forming large patches or tufts. Stems  $\frac{1}{4}$ – $\frac{1}{2}$  inch high; leaves aeuminate, rather thin and flaccid; leaf-cells large; fruitstalk about  $\frac{1}{2}$  an inch high; sporangium erect, subglobose, somewhat contracted towards the base; mouth of sporangium narrower than in the last; spores granulated; ring, according to Schimper, rather wide, composed of two rows of cells.

The leaf-cells resemble those of *Splachnum*.

#### 46. ENTOSTHODON, *Schwæg.*

Sporangium symmetrical, erect or suberect, more or less pyriform, mostly solid; peristome rudimentary or single, of sixteen remotely articulated narrow teeth, confluent at the base; veil swollen below, hood-shaped. *Terrestrial subbiennial Mosses.*

1. *E. ericetorum*, *Schimp.*; stem short; lower leaves remote, lanceolate; upper subresulate, obovato- or spatulato-lanceolate, margined, toothed above, or nearly entire; sporangium erect, small, pyriform; lid convex.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 1245.*; (*Moug. & Nest. n. 1004.*)

On moist shady banks, heaths, etc., especially in mountainous districts. Bearing fruit in spring.

Monoicous, gregarious; leaves with a thickened toothed margin; leaf-cells rather large; nerve reaching nearly to the tip; sporangium smaller than in the next, pyriform, constricted below the mouth when dry; veil cloven on one side only.

2. *E. fasciculare*, *Müll.*; leaves rosulate above, ovato-oblong, acuminate, sharply toothed; nerve ceasing below the tip; sporangium pyriform; lid convex.—*Hook. & Wils. t. lii.*; (*Moug. & Nest. n. 607.*)

In fields, gardens, on molehills, etc., especially where the soil is clayey. Bearing fruit in April.

Monoicous; densely gregarious or somewhat tufted; leaves not margined; leaf-cells large; veil inflated below, split on one side only; lid plano-convex.

There are occasionally rudiments of a peristome.

3. **E. Templetoni**, *Schwæg.*; upper leaves rosulate or loosely imbricated, obovato-oblong, acuminate; margin slightly thickened, scarcely toothed; sporangium pyriform; sulcate when dry; teeth of peristome simple.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 2433, 2524.*; (Plate 16, fig. 5.)

On dry ditch-banks, and in crevices of rocks. Ireland, Scotland, Wales, and north of England. Bearing fruit in spring.

Monoicous; more or less gregarious. Stem short; lower leaves distant, upper crowded; leaves decurrent; nerve reaching nearly to the tip; cells of disk large, subhexagonal or oblong; those of the margin much elongated and narrow; edge unequal above, but scarcely toothed; fruitstalk short, about  $\frac{1}{2}$  an inch long; sporangium subclavate or pyriform, with a long tapering neck; lid mammillary; teeth reddish, fugacious, nearly horizontal when dry, simple, without any medial line.

#### 47. **FUNARIA**, *Schreb.*

Sporangium obliquely pyriform, thick, subventricose; apophysis tapering into the fruitstalk, even, or furrowed when dry; ring, when present, large; peristome double, outer of sixteen oblique teeth, connected at their tips by a small reticulated circular disk; inner a membrane divided into sixteen lanceolate processes, opposite to the outer teeth, and subadherent at the base; veil swollen at the base, subulate above, at length split on one side.



1. *F. calcarea*, *Wahl.*; stem short; upper leaves erectopatent, obovato-oblong, suddenly acuminate, bluntly toothed or entire; sporangium short, pyriform; lid conico-convex; ring none; fruitstalk short, twisted above to the right when dry.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 1497.*; (*Moug. & Nest. n. 1019.*)

On calcareous banks, walls, etc. Bearing fruit in spring.

Monoicous; forming little loose tufts; lower leaves distant, upper leaves concave, broadly ovate or obovate, suddenly hair-pointed, bluntly toothed or nearly entire; nerve ceasing below the tip; leaf-cells large, as are also those of the nerve though smaller; fruitstalk  $\frac{1}{2}$  an inch long, twisted above to the right and below to the left; lid blunt.

Wahlenberg's name is anterior to that of Schwægriehen, and is rightly restored by Schimper.

2. *F. hibernica*, *Hook.*; stem slightly elongated; leaves spreading, ovato-lanceolate, gradually attenuated, sharply toothed; ring none; sporangium short, pyriform; fruitstalk elongated, twisted throughout to the left.—*Hook. & Wils. t. xx.*; (*Moug. & Nest. n. 726.*)

On calcareous soil in Ireland, North Wales, and Derbyshire. Bearing fruit in spring.

Closely allied to and resembling the last; leaves gradually attenuated, with even, large cells, and decidedly serrate; sporangium less turgid, and the apophysis or neck longer, as well as the fruitstalk, which is differently twisted.

3. *F. hygrometrica*, *Hedw.*; upper leaves crowded, forming a bud-like mass, ovato-oblong, acuminate; perigonal leaves toothed above; nerve reaching to the apex; sporangium pyriform, incurved, deeply furrowed when dry; ring broad, at length revolute; fruitstalk flexuous.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 342.*; (*Plate 16, fig. 6*); *Moug. & Nest. n. 132.*

On the naked soil, especially where burnt. Extremely common, and found in most parts of the world. Bearing fruit through the summer months till winter. *Very small plant.*

Monoicous; gregarious; forming wide patches. Lower leaves distant, upper connivent, very concave, entire; lid plano-convex; the cells arranged spirally, the spiral lines meeting in the centre like the lines in a rose-engined watch-case; border consisting of a single row of straight cells; ring externally yellow, internally red; teeth disposed spirally, red below, nearly white at the tips, with transverse processes which, together with the tips, unite to form a network; inner peristome yellow, divided into sixteen teeth, opposite to those of the outer peristome, between each pair of which there is a little red, elongated, triangular spot; spores small, nearly even.

Male flower discoid. Paraphyses moniliform; upper joints swollen, with distinct grains of chlorophyll.

There is a variety with a slender branched stem, and spreading terminal leaves, and another with a straighter fruitstalk.

#### ORDER XVI. *MEESIETI*, Br. & Schimp.

Sporangium irregularly obovate or obconic, suberect, tapering below into a very long fruitstalk, gibbous at the back; peristome double, not hygrosopic. *Mosses inhabiting marshes, with very long fruitstalks.*

#### 48. *AMBLYODON*, P. Beauv.

Sporangium clavate or subpyriform, incurved, suberect; mouth small and oblique; veil at first conico-mitriform, at length split on one side; peristome double, outer of sixteen short teeth, inner longer, deeply divided into sixteen keeled teeth, without intermediate cilia.

1. *A. dealbatus*, *P. Beauv.*—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 1571.*; (Plate 17, fig. 7); *Moug. & Nest. n. 1121.*

In wet, mountainous spots. Scotland, Ireland, north of England, and Suffolk. Bearing fruit in summer.

Monoicous or polygamous. Leaves pale-green or whitish, ovato-lanceolate or subspathulate, entire or minutely toothed; leaf-cells large, oblong, subhexagonal, very transparent; nerve ceasing below the tip; fruitstalk  $1\frac{1}{2}$  inch long; outer teeth chestnut, obtuse or acute; inner pale.

Exactly connecting *Funaria* with *Meesia*.

#### 49. MEESIA, *Hedw.*

Sporangium suberect, obovate or clavate, curved, gibbous behind; mouth small and oblique; apophysis tapering into the long fruitstalk; veil at first conico-mitriform, inflexed at the base, fugacious; peristome double; outer of sixteen short, obtuse, scarcely hygrometric teeth, entire, or at length cloven, more or less united to the inner, which consists of a membrane divided into sixteen narrow-keeled processes.

1. *M. uliginosa*, *Hedw.*; monoicous and synoicous in the same plant; leaves suberect, lanceolato-subulate, obtuse; nerve thick, reaching nearly to the tip; margin entire, recurved; sporangium pyriform, incurved; lid conical, obtuse.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 1517.*; (Plate 16, fig. 7); *Moug. & Nest. n. 727.*

In wet, mountainous spots. Scotland and north of England. On sand-hills on the sea-shore, Lancashire. Bearing fruit in summer.

Forming dense, short, green tufts, yellowish when dry. Stems  $\frac{1}{2}$ –3 inches high, clothed below with purple rootlets; lower leaves distant; upper crowded, lanceolato-subulate, blunt or more rarely subacute; leaf-cells not very large, broadly

hexagonal or quadrate above, more oblong below; nerve very broad; fruitstalk  $1\frac{1}{2}$  inch or more long; teeth of outer peristome short, blunt, bright-brown; inner twice as long, torulose, pale-yellow; spores very large.

2. *M. longiseta*, *Hedw.*; monoicous; stem elongated, tomentose; leaves distant, spreading, lanceolate or subulato-lanceolate, acute, crisped when dry; margin even, entire; fruitstalk very long; sporangium cernuous, pyriform, incurved; lid conical, obtuse.—*Hedw. St. Crypt. vol. i. t. 21, 22.*; (*Moug. & Nest. n. 327.*)

In peat-bogs. Bearing fruit in summer.

Said to have been found in Ireland by Dr. Scott, but his specimens, with one exception, belong to *Amblyodon dealbatus*, as reported by Mr. Wilson, and this individual may have been of foreign extraction.

It is a tall Moss with extremely long fruitstalks.

#### 50. PALUDELLA, *Ehrh.*

Sporangium cernuous or suberect, slightly curved, and unsymmetrical; ring large, unrolling spirally; peristome double; outer of sixteen lanceolate teeth, marked with a medial line; inner a membrane divided halfway down into sixteen keeled processes without intermediate cilia; lid cloven on one side; leaf-cells toward the upper part of the leaf punctiform.

1. *P. squarrosa*, *Brid.*—*Hook. & Wils. t. 1.*; *Eng. Bot. t. 2767.*; (*Moug. & Nest. n. 1119.*)

In peat-bogs. North of England. Bearing fruit in summer on the Continent, but at present not found in England with fruit.

Dioicous; forming bright-green or yellowish patches. Stems densely clothed with purple rootlets; leaves bent back, from an erect base; nerve ceasing below the tip; margin recurved

below, toothed above; leaf-cells at the base, and part of the way up, oblong; in the upper part of the leaf minute, suborbicular, and prominent.

ORDER XVII. *BRYEI*, Br. & Schimp.

Sporangium erect or cernuous, symmetrical, cylindrical, pyriform or pitcher-shaped, even or sulcate; peristome double; veil hood-shaped; leaves, for the most part, marginate and toothed, with large leaf-cells.

51. *CINCLIDIUM*, *Swartz*.

Sporangium pendulous, more or less pyriform; ring small; veil small, fugacious; peristome double; outer of sixteen, short, obtuse teeth, furnished with prominent membranous plates on the inner side; inner a dome-shaped membrane, adherent below, with sixteen perforations opposite to the outer teeth, and as many keeled, narrow processes alternating with them; spores large.

1. *C. stygium*, *Swartz*; synoious; stems densely tomentose; leaves large, ovate or ovato-oblong from a narrow base, apiculate; border opaque, cartilaginous; nerve reaching to the apex or beyond; sporangium pendulous, subrotundo-pyriform or oval; lid convex, obtuse.—*Hook. & Wils. t. lii.*; *Eng. Bot. t. 2840.*; (Plate 17, fig. 1.)

In spongy bogs. Yorkshire and Suffolk, in which latter county it has been found by Mr. E. Skepper, who has kindly sent me specimens. Bearing fruit in summer.

Forming large tufts. Stems long, matted together with purple rootlets; leaves rosular at the apex, crisped when dry, often coloured; leaf-cells radiating from the nerve; fruit-stalks mostly solitary; inner peristome deep sienna-brown, the ribs red, and occasionally perforated, as is the membrane

near them ; both above and below there are imperfect cilia between the ribs.

### 52. **MNIUM**, *Br. & Schimp.*

Sporangia often aggregate, pendulous, ovate or oblong, but not pyriform, with scarcely any apophysis, the spore-sac filling up the cavity at the base ; ring compound, unrolling spirally ; peristome double ; outer of sixteen, very hygroscopic teeth ; inner a membrane, divided halfway into sixteen keeled mostly perforated processes with intermediate cilia ; veil small, hood-shaped ; spores small ; paraphyses of male flower clavate. *Mosses with large leaves, the leaf-cells mostly radiating from the nerve, the innovations usually from the lower part of the fertile stem.*

Sect. I. *Innovations stoloniform, subterraneous or creeping.*

*a. Leaves with the bordered margin simply toothed.*

1. **M. affine**, *Bland.* ; dioicous ; fertile stems erect, simple ; stolons very long, arched ; upper leaves rosulate, obovato-oblong, apiculate ; border narrow, sharply toothed ; sporangia ovato-oblong, mostly aggregate ; lid convex, apiculate.—*Hook. & Wils. t. li. ; Eng. Bot. t. 2739. ; (Plate 17, fig. 2) ; Moug. & Nest. n. 930.*

In woods and marshes. Scotland, north of England, and Suffolk. Bearing fruit, but rarely, in spring.

Forming tall wide tufts. Leaves spreading, recurved when dry, the reflected wings and margin crisped ; lower leaves distant, elliptico-lanceolate, upper elliptico-oblong ; fruitstalks 1–2 inches long, often two or more together. A larger plant than *M. cuspidatum*.

It varies in the length of the stem and fruitstalk, in the length and direction of the stolons, the length of the leaves,

and the sharpness of the serratures. Sometimes in very alpine situations the serratures disappear. *Mnium insigne*, Mitten, is considered by Schimper as a long-leaved variety.

2. *M. cuspidatum*, *Hedw.*; synoicous; stem erect, simple; lower leaves obovato-acuminate, upper leaves ovato-lanceolate; sporangium subpendulous, ovate; lid convex, obtuse.—*Hook. & Wils. t. xxxi.*; *Eng. Bot. t. 1474.*; (Plate 17, fig. 3); *Moug. & Nest. n. 621.*

On shady rocks and walls, especially in calcareous districts. Bearing fruit in spring.

Stems simple, with creeping or suberect stolons, very tomentose below. Lower leaves distant, broadly ovato-acuminate; upper more elongated, crisp when dry; margin cartilaginous, toothed; nerve ceasing at or just below the tip; sporangium solitary; lid mostly obtuse.

The synoicous inflorescence is the most certain distinctive mark, taken in conjunction with the size and broad solitary sporangia and the blunt lid. The leaf-cells moreover are not half the size, and very different.

3. *M. undulatum*, *Hedw.*; dioicous; stem dendroid, with flagelliform arched branches and creeping stolons; leaves more or less ligulate, undulated, decurrent; margin broad but thin, simply toothed from the base; sporangia aggregate, oval-oblong, pendulous; lid convex, apiculate.—*Hook. & Wils. t. xxx.*; *Eng. Bot. t. 1449*; (Plate 17, fig. 4); *Moug. & Nest. n. 420.*

Woods, shady banks, etc. Fruiting, but rarely, in spring.

Forming extensive green patches. Stolons ascending, pendulous above; stems erect, simple, or branched above, and dendroid with curved flagelliform branches; leaves spreading, decurrent, variable in length, oval-oblong or strap-shaped, undulated, obtuse, crisped when dry; margin narrow, toothed; nerve ceasing below the tip or subexcurrent; leaf-cells like

those of *M. cuspidatum*; fruitstalks long; lid convex with a small point.

One of our finest and most common Mosses.

4. *M. rostratum*, *Schwæg.*; synoicous; stems short, simple, erect; stolons elongated; lower leaves ovate, upper oval-oblong, obtuse, subapiculate; margin cartilaginous, toothed fruitstalks aggregate; sporangia oval, subpendulous; lid rostrate.—*Hook. & Wils. t. xxx.*; *Eng. Bot. t. 1475.*; (Plate 17, fig. 5); *Moug. & Nest. n. 419.*

In shady spots near springs, on moist rocks, etc. Bearing fruit in spring.

Forming thin patches. Lower leaves of stem and branches broadly obovate from a narrow base; upper rosulate leaves more spathulate; nerve running into the short apiculus; leaf-cells rather small; lid decidedly rostrate.

Sect. II. *Innovations resembling stems; branches erect.*

*a. Leaves margined with two rows of teeth.*

5. *M. hornum*, *L.*; dioicous; stems and branches erect; leaves crowded, rigid, oblongo-lanceolate, erecto-patent, subdecurent, doubly serrated; border cartilaginous; sporangium oblongo-ovate, subpendulous; lid mammillary.—*Hook. & Wils. t. xxxi.*; *Eng. Bot. t. 2271.*; (*Moug. & Nest. n. 34.*)

Woods, shady banks, etc. Extremely common. Bearing fruit in spring.

Forming broad, dense green tufts. Stems matted together with ferruginous rootlets; leaves rigid, straight; margin thick with a double row of spinulose serratures; nerve ceasing below the tip, spinulose; leaf-cells moderately large; sporangium varying in diameter; lid convex with a small point.

6. *M. serratum*, *Brid.*; synoicous; stem and radical branches erect; leaves remote, soft, obovate, lanceolate, and



obovato-oblong, acuminate, doubly serrated, bordered; sporangium ovate, subpendulous; lid shortly beaked.—*Hook. & Wils. t. xxxi.*; *Eng. Bot. t. 1473.*; (*Moug. & Nest. n. 1128.*)

In crevices of rocks, amongst stones, etc., especially in a calcareous soil. Bearing fruit in spring.

Forming loose bright tufts. Stems purple, short, slender, simple, clothed with rootlets at the base, but not matted together; the basal shoots erect; leaves crisped when dry, often much tinged with red; leaf-cells rather larger than in the last.

7. *M. orthorrhynchum*, *Brid.*; dioicous; densely cæspitose; stem simple; leaves more or less ovato-lanceolate, acuminate, decurrent; border cartilaginous, doubly serrated; sporangium horizontal, oval; lid conico-rostellate.—*Hook. & Wils. t. li.*; *Moug. & Nest. n. 1129.*)

Amongst stones in woods, etc. Bearing fruit in early spring. Yorkshire and Sussex.

More robust than the last; the margin and spinulose nerve strongly marked; leaf-cells much smaller, by which latter character, as well as the horizontal sporangium and dioicous inflorescence, it differs from the last. The leaves vary much in breadth, and are scarcely curled when dry.

*b. Leaves not bordered.*

8. *M. stellare*, *Hedw.*; dioicous; stems and branches erect; leaves erecto-patent, oblong, acuminate, not bordered, toothed; sporangium cernuous, ovate; lid hemispherical, obtuse.—*Hook. & Wils. t. li.*; (*Moug. & Nest. n. 1131.*)

Shady rocks and banks, especially in calcareous districts. Yorkshire, Surrey. Bearing fruit in early summer.

Forming soft, deep-green patches. Leaves increasing in size upwards, oblong or subspathulate, acuminate; leaf-cells moderately large; nerve ceasing below the tip; lid convex, without any apiculus.

9. *M. cinclidioides*, *Blytt.*; dioicous; stems and radical branches erect, elongated; leaves large, rounded, somewhat ovate or oval-oblong, toothed or nearly entire; sporangium pendulous, oval; lid convex, apiculate.—*Hook. & Wils. t. li.*; (*Moug. & Nest. n. 931.*)

In bogs, amongst the Scottish mountains. Bearing fruit on the Continent in June.

Forming dense yellowish patches. Stems much elongated, lower leaves rounded, somewhat ovate or oblong; upper broadly lingulate, often emarginate, with a short apiculus; leaf-cells rather large; marginal cells narrow, but not forming a cartilaginous border, though they vary in different parts of the same leaf.

A very fine species. Mougeot's specimens are either mixed with some other species, or the leaves have sometimes a thick swollen border.

*c. Leaves distinctly bordered, quite entire.*

10. *M. punctatum*, *Hedw.*; dioicous; stem and radical branches erect; leaves spreading, roundish; upper leaves sub-ovate, entire, strongly bordered, with a minute apiculus; sporangium subpendulous, oval; lid shortly beaked.—*Hook. & Wils. t. xxx.*; *Eng. Bot. t. 1183.*; (Plate 17, fig. 6); *Moug. & Nest. n. 136.*

On shady banks, near springs, etc., especially in sandy or slaty districts. Bearing fruit in spring.

Forming wide patches of a deep-green above, and reddish below. Leaves crisped when dry; leaf-cells large; nerve reaching to the tip or ceasing a little below; lid conical, beaked, shorter than the sporangium.

A most beautiful Moss. In those parts of Wales where this Moss abounds, and Rhododendrons flourish, the seedlings take root in the tufts better than in any other situation.

11. *M. subglobosum*, *Br. & Schimp.*; synoicous; stems slender, erect, as well as the radical shoots; leaves spreading, roundish, obovate, obtuse, entire; border narrower; sporangium roundish, small; lid shortly beaked.—*Hook. & Wils. t. li.*; *Eng. Bot. t. 2907.*

In bogs, north of England and Scotland. Bearing fruit in early spring.

A more delicate plant than the last, with less crowded leaves, a narrower less cartilaginous border, and a shorter more globose sporangium. The inflorescence also is different, and the spores larger.

This, and the preceding species, approach in the character of their innovations to *Bryum*.

### 53. *ZIERIA*, *Schimp.*

Sporangium pyriform or subpyriform, with a long neck, gibbous at the base; mouth oblique; ring broad; peristome double; outer of sixteen lanceolate teeth; inner a plicate membrane, divided into sixteen more or less cloven or perforated teeth, longer than the outer, with rudimentary intermediate processes; leaf-cells large, hexagono-rhomboid.

1. *Z. julacea*, *Schimp.*; leaves ovate, acuminate, concave, imbricated, entire; nerve ceasing below the tip; sporangium more or less inclined, incurved; neck longer than the sporesac.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 1021*; (Plate 18, fig. 1); *Moug. & Nest. n. 1122.*

In moist crevices of alpine rocks. England, Scotland, Ireland, and Wales. Bearing fruit late in autumn.

Dioicous; forming soft patches, at first green, then silvery-white or pinkish. Stems short; leaves closely imbricated, very concave, thin, membranous, almost colourless, except at the base; fruitstalk about  $\frac{1}{2}$  an inch long, arched above; sporan-

gium at first confluent with the long tapering neck, then more swollen.

In outward aspect, apart from the sporangium, resembling somewhat *Bryum argenteum*.

2. **Z. demissa**, *Schimp.*; leaves ovate, cuspidato-acuminate; margin recurved; nerve ceasing below the apex or excurrent; sporangium decidedly cernuous, incurved; neck scarcely so long.—*Hook. & Wils. t. xxxvi.*; *Grev. Sc. Crypt. Fl. t. 92.*

Summits of Breadalbane mountains. Bearing fruit at the end of summer.

Dioicous; forming reddish patches. Stem shorter than in the last; lower leaves ovato-acuminate, nerve generally ceasing below the apex; upper hair-pointed with the nerve excurrent, erecto-patent, entire; fruitstalk strongly arched, about  $\frac{1}{2}$  an inch long; sporangium clavate, with a shorter tapering neck; inner peristome much longer than the outer teeth, the divisions of the teeth variously united.

#### 54. **ANOMOBRYUM**, *Schimp.*

Sporangium symmetrical; peristome double, outer of sixteen teeth, inner a plicate membrane split into sixteen more or less cleft processes, with one or more intermediate cilia; leaf-cells hexagono-rhomboid and rectangular towards the base, very narrow above, especially towards the margin, vermiform towards the nerve.

1. **A. julaceum**, *Schimp.*; leaves densely imbricated everywhere, nearly equal, ovate, concave, blunt; margin plane, entire or minutely toothed above; nerve ceasing below the apex or slightly excurrent; sporangium drooping, oblongo-obovate; lid mammillary.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 2270.*

On damp rocks in alpine or subalpine districts. England, Ireland, Scotland, and Wales. Bearing fruit in autumn.

Dioicous; forming bright green or yellowish irregular patches. Stem 1-3 inches high; fruitstalk 1 inch high, arched; lid convex, with a small apiculus.

55. **BRYUM**, *Dill.*

Sporangium symmetrical, confluent with the narrow apophysis; peristome double; outer of sixteen lanceolate teeth, inner a plicate membrane, divided halfway down into sixteen keeled processes, alternating with the outer teeth and mostly intermediate cilia, with prominent appendages at the internodes; innovations from the floral apex; paraphyses of male flowers filiform.

Sect. I. *Cilia and teeth of inner peristome adherent or free; cilia imperfect, or if perfect without appendages.*

1. **B. uliginosum**, *Br. & Schimp.*; monoicous; stem densely radiculose, with a few short branches above; leaves erect below, spreading above, ovali-lanceolate, with a narrow dark border; margin reflected below, denticulate at apex; nerve excurrent; sporangium long-necked, pendulous, elongato-pyriform, slightly curved and irregular; mouth small, oblique.—*Hook. & Wils. t. xlvi.*

In wet places near rills. Bearing fruit towards the end of summer.

Forming green tufts. Nerve acquiring a red tint; fruitstalk long, arched above; sporangium rather gibbous behind, not contracted beneath the orifice when dry; cilia wanting or rudimentary; lid minute.

This species approaches in some of its characters to *Zieria*, but the reticulation of the leaves is very different.

2. **B. pendulum**, *Hornsch.*; synoicous, densely tufted, radiculose; stem branched; leaves crowded, erecto-patent, ovate, acuminate, concave; nerve excurrent; margin reflected, more

or less toothed above; sporangium ovate or ovato-globose; mouth and conical apiculate lid small.—*Hook. & Wils. t.* xlvi. ; (*Moug. & Nest. n.* 828.)

On walls and on the ground. Bearing fruit in the beginning of summer.

Forming short green patches. Leaves scarcely crisped when dry; margin reflected for two-thirds of their length; excurrent nerve and base reddish; internal peristome adherent, the teeth and cilia partly free.

Distinguished from *B. cæspiticium* by its narrow mouth.

3. *B. inclinatum*, *Br. & Schimp.*; synoicous; cæspitose; leaves spreading, ovato-lanceolate, acutely keeled above; nerve excurrent; sporangium pendulous, more or less pyriform and ventricose; mouth small; lid apiculate.—*Hook. & Wils. t.* xlix. ; (*Moug. & Nest. n.* 829.)

On walls, banks, trunks of trees, etc. Bearing fruit in early summer.

Forming green patches. Leaves narrower and longer; margin reflected; sporangium generally more slender; inner peristome free above; processes perforated; cilia rudimentary or wanting.

This is distinguished from the foregoing species by the longer more spreading leaves, longer sporangium, and nearly free inner peristome.

4. *B. Warneum*, *Bland*; monoicous or synoicous; stem branched, radiculose; innovations short, often flagelliform; leaves ovate or oblongo-lanceolate; margin recurved; nerve continued to the serrulate apex; sporangium pendulous, pear-shaped, ventricose; lid small, convex, apiculate; processes of inner peristome very narrow; cilia rudimentary.—*Hook. & Wils. t.* xii.

Sides of rivers and ponds. Fife and Lancashire. Bearing fruit at the end of summer.

Forming irregular tufts. Membrane of inner peristome adhering to outer teeth; processes free; cilia rudimentary; border of orifice glossy.

Closely allied to the next species.

5. **B. lacustre**, *Bland*; synoicous; stems short, branched, radiculose; lower leaves distant, widely ovate, acute, upper crowded, ovato-lanceolate, concave, entire; margin reflected; nerve reaching almost to the apex or excurrent; sporangium soft, inclined, oblongo-pyriform; lid small, apiculate; cilia rudimentary.—*Hook. & Wils. t. xviii.*

Moist sandy places. Suffolk and Norfolk. Bearing fruit in summer.

Forming loose irregular tufts. Stems very short; leaves very concave; leaf-cells large; sporangia inclined or pendulous, variable in size in the same tuft as is the length of the fruitstalk, rugulose when dry, not constricted below the mouth.

6. **B. calophyllum**, *Brown*; monoicous; stem slightly radiculose; upper leaves erecto-patent, widely ovate, entire, subacute with an obtuse apiculus; sporangium elliptico-oblong, pendulous; lid short, convex, more or less apiculate; inner peristome free.—*Hook. & Wils. t. xxxiii.*

On the sandy shore at Southport, Lancashire. Bearing fruit in September.

Gregarious; forming little green tufts. Stem short; leaf-cells large; teeth of outer peristome yellow-brown, inner peristome free; cilia rudimentary or solitary and appendiculate.

7. **B. Marratii**, *Wils.*; monoicous; stem slightly radiculose; leaves spreading, concave, elliptic, obtuse, entire; fruitstalk long and slender; sporangium small, pendulous, subglobose-turbinate; lid conical, rostellate; inner peristome adherent.—*Hook. & Wils. t. xxxii.*

On the sandy shore at Southport with the last. Bearing fruit in September.

Gregarious. Margin of leaves scarcely reflected; mouth of sporangium small; teeth of outer peristome deep-red; inner peristome adherent; cilia rudimentary.

Sect. II. *Inner peristome free; processes long, perfect, with intermediate cilia of the same length appendiculate at the articulations.*

8. **B. intermedium**, *Br. & Schimp.*; synoicous, broadly cæspitose; stem radiculose, with short innovations; leaves loosely imbricated, ovato- or elongato-lanceolate; nerve excurrent; sporangium elongated, with a long neck; lid acute. *Hook. & Wils. t. xlix.*; (*Moug. & Nest. n. 927.*)

On walls, rocks, etc. Bearing fruit in summer and autumn.

Forming broad bright-green patches, matted together below by copious rootlets. Leaves more or less spreading; margin strongly reflected; nerve reddish, especially below, running out into a toothed hair-like point; sporangium cernuous, rather thin, pendulous, sometimes slightly curved. Ripening its fruit at intervals for several months in succession.

9. **B. bimum**, *Schreb.*; synoicous; cæspitose, simple or branched, radiculose; leaves spreading, ovato- or oblongo-lanceolate, concave, keeled; margin recurved, narrow-celled, twisted when dry; sporangium pendulous, oblongo-pyriform, contracted below the mouth when dry; lid broadly mammillary.—*Hook. & Wils. t. xlix.*; *Eng. Bot. t. 1518*; (*Moug & Nest. n. 1216*).

In boggy places, on wet rocks and walls. Bearing fruit in summer. North of England.

Forming green or olive shorter or taller patches, matted together with purple rootlets.

Often confounded with *B. pseudotriquetrum*, but distinguished by the bisexual inflorescence, less crowded and less solid distinctly cuspidate leaves, the shorter sporangium, and wider shorter lid.



10. *B. torquescens*, *Br. & Schimp.*; synoicous; stem short, radiculose, with short branches; leaves ovato-lanceolate and ovate, cuspidate, more or less spreading, twisted when dry, entire; margin reflexed; nerve excurrent; sporangium obconical, large, subpendulous; lid apiculate.—*Hook. & Wils. t. xlix.*; (*Moug. & Nest. n. 1021.*)

On walls and rocks. Sussex. Bearing fruit in summer.

Forming short wide-spreading tufts. Stem simple or divided; leaves entire; nerve excurrent into a hair-like point; sporangium inclined or pendulous; lid acutely apiculate.

11. *B. pallescens*, *Schleich.*; monoicous, pulvinate; stem branched, radiculose; leaves ovato-acuminate or oblongo-acuminate, entire; margin reflexed; nerve mostly excurrent; sporangium cernuous, clavato-pyriform; lid conical, acuminate.—*Hook. & Wils. t. xlvi.*; (*Moug. & Nest. n. 728.*)

On rocks and walls in mountainous districts. Scotland, Ireland, and north of England. Bearing fruit in summer.

Compactly tufted, green above, below brownish with rusty rootlets. Lower leaves tinged with red, with a scarcely excurrent nerve, entire or toothed at the apex; sporangium contracted below the mouth when dry.

In moist places 2 or 3 inches high, in dry situations about as many lines.

12. *B. erythrocarpum*, *Schwæg.*; dioicous; stem short, simple or branched; leaves erecto-patent, ovato-lanceolate or lanceolate, mostly toothed at the apex; nerve excurrent; margin almost plane; sporangium inclined or pendulous, oblongo-pyriform or somewhat obconical; lid convex, apiculate.—*Hook. & Wils. t. 1.*; *Eng. Bot. t. 1601.*; (*Moug. & Nest. n. 1023.*)

On heaths, walls, etc. Bearing fruit in summer.

Forming thin scattered patches. Leaves straight when dry; sporangium of a deep blood-red when ripe.

Mitten distinguishes a species from this, under the name of *B. rubens*, with more elliptic leaves, a clavato-oblong sporangium, and large short conical acute lid. He does not say whether he has found it in England, but he suspects it may be the same with *B. radiculosum*, Brid., which is Wilson's var.  $\beta$ .

13. **B. atro-purpureum**, *Web. & Mohr*; dioicous; stem radiculose; leaves lanceolate and ovato-acuminate, entire, loosely imbricated above; nerve slightly excurrent; margin reflexed below; sporangium oval or oval-oblong, constricted below the mouth.—*Hook. & Wils. t. 1.*; (*Moug. & Nest. n. 832.*)

On walls, dry pastures, etc. Bearing fruit in early summer.

Differs from the last in the shorter thicker sporangia, and the broader, shorter, subimbricated leaves. Sporangia deep-red or purplish when ripe. The character, from the degree of reflexion of the margin of the leaf, is, I fear, not constant. As *Bryum apiculatum*, Wils., has not yet been found in fruit, it is perhaps better to omit it.

14. **B. alpinum**, *L.*; dioicous; densely tufted. Stem simple, radiculose at the very base; leaves crowded, imbricated, erecto-patent, straight, more or less lanceolate; nerve rigid, excurrent; sporangium pendulous, oblongo-pyriform, constricted below the mouth when dry.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 1623.*; (*Moug. & Nest. n. 221.*)

On moist mountain-rocks, and near the sea. Bearing fruit in summer.

Forming dense purplish tufts. Leaves straight when dry; margin recurved; nerve forming a short apiculus; sporangium red; lid mammillary.

15. **B. Mühlenbeckii**, *Br. & Schimp.*; dioicous; caespitose. Stem dichotomously branched, densely radiculose; leaves suberect, imbricated, ovate or oblong, elongated, gradually

pointed, bluntish; margin revolute; sporangium oblong, more or less pendulous, not shining.—*Hook. & Wils. t. xlviii.*

On moist mountainous rocks. Devonshire. Bearing fruit in September.

Differs from *B. alpinum* in its olive-green tint, broader bluntish leaves, with larger leaf-cells, and its rusty or bay, not purple sporangia.

16. *B. cæspiticiu*m, *L.*; dioicous; stem branched and innovated, radiculose; leaves erecto-patent, erect and straight when dry, lanceolate or oblongo-lanceolate; margin mostly entire, reflexed, concave; nerve excurrent, forming a long hair-point; sporangium oblong, obovate, pendulous, slightly constricted below the mouth when dry; lid large, mammillary.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 1904.*; (*Moug. & Nest. n. 134, 929.*)

On walls, rocks, the bare ground, etc. Bearing fruit in early summer. Forming little dense tufts of a pale green.

A very common and variable plant as to the direction and serrature of the leaves, shape of the sporangium, etc.

17. *B. argenteu*m, *L.*; dioicous; silvery-white, tufted; upper leaves closely imbricated, ovato-lanceolate, very concave, entire, apiculate; nerve not excurrent; leaf-cells large; sporangium oval-oblong, pendulous; lid mammillary.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 1602*; (*Moug. & Nest. n. 133.*)

On the naked soil, walls, roofs, etc. Extremely common; cosmopolitan. Bearing fruit in winter and early spring.

Forming little patches, conspicuous for their silvery colour, and the closely imbricated leaves with colourless tips. Sporangium purplish or reddish, constricted below the mouth when dry; lid convex, slightly pointed.

18. *B. capillare*, *Hedw.*; dioicous; leaves more or less spreading, strongly twisted when dry; upper leaves obovate

oblong, abruptly hair-pointed; sporangium cernuous, oblongo-pyriform, clavate or obovate; lid apiculate.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 1862 (in part), 2007, 2434.*; (*Moug. & Nest. n. 33.*)

On walls, rocks, trees, etc. Very common. Bearing fruit in spring. *Requiem in Feb. 2007*

A very variable species, distinguished from *B. caespitium* by the form and character of the leaves. The lower leaves are not so broad in the middle; margin reflexed, narrow-celled, entire or slightly toothed; nerve ceasing below the apex or excurrent.

19. *B. obconicum*, *Hornsch.*; dioicous; tufted, radiculose; upper leaves crowded, erecto-patent, scarcely twisted when dry, pointed; nerve excurrent, forming a long hair-point; margin revolute, narrow-celled but not thickened; sporangium pendulous, clavate, long-necked; lid mammillary.—*Hook. & Wils. t. xlix.*

On walls. Barnard Castle, Mr. Spruce. Bearing fruit in summer.

Intermediate between *B. caespitium* and *capillare*. It differs from the latter in the leaves not being narrow towards the base, in their being scarcely twisted and somewhat imbricated, in the longer neck of the sporangium, which is narrower and pendulous, on a more arched fruitstalk; from the former, in the narrowly obconical, symmetrical sporangium, which has a polished cartilaginous border when dry.

20. *B. Donianum*, *Grev.*; dioicous; leaves spreading, slightly crisped when dry, but not decidedly twisted; ovato-oblong, with a narrow thickened border, slightly serrated above; nerve scarcely excurrent; sporangium conico-clavate, subpendulous; lid apiculate.—*Hook. & Wils. t. xlix.*; *Grev. in Linn. Tr. vol. 15, t. 3, f. 6.*

On rocks and sandy banks. Lancashire, Sussex, and Wales. Bearing fruit in early summer.

The thickened border, consisting of two layers of cells, and more solid leaves distinguish this from nearly allied species. It has the habit of *B. capillare*.

21. *B. canariense*, *Brid.*; dioicous; stem branched, with short innovations; upper leaves crowded into whorls, erecto-patent, undulated when dry, ovato-oblong, concave, serrulate, recurved below, toothed above; nerve more or less excurrent; sporangium obconico-pyriform, pendulous; lid conico-apiculate.—*Hook. & Wils. t. 1.*

On old ant-hills, Sussex, Mr. Mitten. Bearing fruit in summer.

Distinguished, according to Schimper, from *B. capillare* by the form of the leaves, the margin sharply toothed above, revolute below, and narrowly bordered, their firmer consistence, and brilliancy, their imbrication when dry, and their smaller shorter sporangium.

22. *B. pseudotriquetrum*, *Schwæg.*; dioicous, caespitose; stem erect, slightly branched, radiculose; leaves erecto-patent, subdecurrent, ovato-lanceolate, concave, slightly bordered; margin recurved, entire or slightly toothed at the apex; nerve reaching to or slightly beyond the tip; leaf-cells rather narrow; sporangium ovali-pyriform, oblong or subcylindrical, pendulous; lid mammillary.—*Hook. & Wils. t. xxx.*; *Eng. Bot. t. 2554.*; (*Moug. & Nest. n. 223.*)

On moist marshy ground, wet rocks, especially in mountainous districts. Scotland and Wales. Bearing fruit in summer.

Forming large green tufts variegated with purple; from 1 to 6 inches long; leaves when dry rigid, slightly incurved or crisped, by which it is distinguished from *B. bimum* as also by its generally longer sporangium.

23. **B. pallens**, *Swartz*; dioicous, stem short, soft, red; branches elongated, slender; leaves more or less spreading, ovato-acuminate or ovali-lanceolate, mucronate; border slightly thickened and recurved; nerve slightly excurrent; sporangium subclavato-pyriform, incurved, cernuous, long-necked; lid small, convex, pointed.—*Hook. & Wils. t. xxix.*; (*Moug. & Nest. n. 729.*)

Near springs. Bearing fruit in June.

Forming soft pale reddish patches. Stem 1–3 inches long; lower leaves distant, upper more crowded; sporangium contracted beneath the mouth when dry.

24. **B. turbinatum**, *Schwæg.*; dioicous; tufted, rather rigid; stem simple or branched; leaves crowded, erecto-patent, subdecurrent, ovato-lanceolate, obscurely toothed above; nerve running out into a very short point; margin reflexed towards the base; sporangium pendulous, broadly pyriform, contracted below the mouth when dry; lid mammillary.—*Hook. & Wils. t. xlvi.*; (*Moug. & Nest. n. 222.*)

In wet places. Lancashire and Norfolk.

Forming thick pale-green or reddish patches. Stem short or elongated; leaves concave, distant in the lower part of the stem, crowded above.

In general, easily known from the last by the absence of any decided green tint; the leaves moreover are not so acuminate, the margin quite even above, and the sporangium of a different shape and not long-necked.

25. **B. roseum**, *Dill.*; dioicous; stem decumbent at the base; upper leaves very large, spathulato-acuminate, serrated above; margin reflexed below; nerve reaching almost to the tip; sporangia pendulous, oblong, slightly incurved, lid mammillary.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 2395.*; (Plate 18, fig. 2). *Moug. & Nest. n. 833.*

On shady banks, especially in sandy districts. Bearing fruit in winter.

Forming broad patches; innovations from the upper part of the fruit-bearing stems and from creeping stolons; upper leaves rosulate; lower leaves very small.

A splendid Moss, with the appearance of *Mnium*, but the characters of *Bryum*.\*

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\* As the genus *Bryum* is a very difficult one, on account of the really distinctive characters being often difficult of access, I subjoin Mr. Wilson's arrangement, so far as it relates to the species here included under the genus.

Sect. I. Nerve ceasing below the apex.

*Bryum Marratii.*

— *calophyllum.*

Sect. II. Leaves mostly ovate, nerved to the apex.

a. Inflorescence synoicous.

— *lacustre.*

— *Warneum.*

b. Inflorescence dioicous.

— *pseudotriquetrum.*

— *alpinum.*

— *Mühlenbeckii.*

— *turbinatum.*

— *pallens.*

Sect. III. Leaves ovate, nerve excurrent.

a. Inflorescence monoicous.

— *uliginosum.*

— *pallescens.*

b. Inflorescence synoicous.

\* Inner peristome imperfect.

— *pendulum.*

— *inclinatum.*

\*\* Inner peristome perfect.

— *intermedium.*

— *bimum.*

— *torquescens.*

c. Inflorescence dioicous.

— *obconicum.*

— *capillare.*

— *Donianum.*

56. **WEBERA**, *Hedw.*

Fruit as in *Bryum*. Innovations mostly from the base; stem mostly slender; leaves narrow; leaf-cells hexagonal, elongated.

The innovations are certainly not always from the base, the generic character therefore must rest more on habit and the nature of the leaves than on anything very definite in point of structure. The genus is retained here because the species it contains form a natural group, and, with the exception of *W. Tozeri*, are associated in Wilson's arrangement.

*a. Leaves narrow.*

\* *Sporangium with a long neck.*

1. **W. acuminata**, *Schimp.*; upper leaves long, lanceolate, sulcate, obscurely serrate at the tip; margin recurved; nerve reaching to the tip; sporangium slender, with a long tapering neck, horizontal; lid acutely conical.—*Hook. & Wils. t.* xlvii.

On mountains. Scotland, Wales, and north of England. Bearing fruit in autumn.

Forming short tufts. Leaves erect, straight, sometimes secund; lid sometimes rostellate; inner peristome very deeply divided; processes mostly narrow and pierced; cilia absent.

2. **W. polymorpha**, *Schimp.*; monoicous; antheridia free, axillary; upper leaves crowded, oblongo-lanceolate, the nerve

*Bryum canariense.*

— *cæspiticium.*

— *erythrocarpum.*

— *atropurpureum.*

Sect. IV. Leaves very concave, closely imbricated; nerve mostly ceasing below the apex.

— *argenteum.*

Sect. V. Leaves very large.

— *roseum.*



ceasing below the toothed apex; sporangium oblongo-pyriform; neck shorter than the spore-sac; lid mammillary.—*Hook. & Wils. t. xlvii.*; *Eng. Bot. t. 1003.*

Scottish and Welsh mountains. Bearing fruit in summer.

Differing from the last in inflorescence, the shorter more clearly serrated leaves, the longer nerve, and the shorter neck. There are no cilia in the inner peristome.

3. *W. elongata*, *Schwæg.*; monoicous; upper leaves lineari-lanceolate, erecto-patent, nearly straight, toothed at the apex; margin recurved below; sporangium elongato-elliptic; neck longer than the spore-sac; lid acute; cilia none or imperfect.—*Hook. & Wils. t. xxx.*; (*Moug. & Nest. n. 32.*)

On rocks, banks, etc., especially in alpine or subalpine districts. Bearing fruit in summer.

Gregarious or forming little tufts. Lower leaves scattered, ovato-lanceolate, upper spreading or erect; lid sometimes almost rostrate.

\*\* *Neck of sporangium short, membrane of inner peristome broader; cilia perfect.*

4. *W. nutans*, *Hedw.*; monoicous; upper leaves gradually longer, lineari-lanceolate, toothed at the apex; sporangium pendulous, ovali-pyriform; lid mammillary.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 1240.*; (*Moug. & Nest. n. 220, 1123, 1124.*)

On heaths, rocks, etc. Bearing fruit in spring.

Forming green tufts. Stem reddish; antheridia generally in the axils of the leaves, but occasionally mixed with the archeogonia; ring large; nerve of leaves ceasing at or below the apex; cilia decidedly appendiculate, though Schimper's generic character would indicate the contrary.

A most variable species.

5. *W. cruda*, *Schimp.*; synoicous or dioicous; stem simple; upper leaves crowded, lineari-lanceolate, toothed above, flexuous; nerve ceasing below the toothed apex; sporangium oblong, frequently ventricose; lid convex, apiculate.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 1604.*; (*Moug. & Nest. n. 512.*)

Rocks or banks, especially in alpine districts. Bearing fruit in summer.

Forming glaucous patches. Stem reddish, simple or with basal innovations; lowest leaves broadly ovali-lanceolate, the next ovato-lanceolate, the terminal ones only very narrow, not twisted or crisped when dry, reddish at the base; sporangium often gibbous and irregular; cilia appendiculate. The finest species of the genus *Webera*.

6. *W. annotina*, *Schwæg.*; dioicous; loosely tufted; stem erect; branches elongated, straight, bulbiferous; leaves, especially the upper, more or less lanceolate, toothed at the apex; margin reflexed below; sporangium subpendulous, oblongo-pyriform; lid apiculate.—*Hook. & Wils. t. xlvii.*; *Eng. Bot. t. 2856.*; (*Moug. & Nest. n. 928.*)

In sandy ground. Bearing fruit in early summer.

Forming yellowish patches. Stem very short; innovations elongated and slender; leaf-cells moderately large; sporangium pale-red when young, dark-red when old, constricted when dry beneath the mouth.

The little bulbs are very characteristic.

7. *W. carnea*, *Schimp.*; dioicous; lower leaves lanceolate or ovato-lanceolate; upper lineari-lanceolate, toothed at the apex; nerve vanishing below the toothed apex; leaf-cells rather large; fruitstalk thick and succulent, bent immediately below the neck of the ovato-oblong subpendulous sporangium; lid convex, apiculate; peristome large; ring none.—*Hook. & Wils. t. xxix.*; *Eng. Bot. t. 360.*; (*Moug. & Nest. n. 1021.*)

Moist clayey banks, etc. Bearing fruit in spring.

Forming loose tufts or gregarious; often throwing out shoots from the base. Leaf-cells large, elongated; those at the margin narrow; sporangium reddish. The large peristome, wide leaf-cells, and peculiar fruitstalk, abundantly distinguish this from all the preceding species.

*b. Lower leaves ovate; upper only lanceolate.*

8. *W. Ludwigii*, Schimp.; dioicous, tufted; stem decumbent; lower leaves ovate, then ovato-lanceolate, obtuse, more or less decurrent, finally lineari-lanceolate and toothed; margin slightly reflexed; fruitstalk very slender, geniculate at the base; sporangium pyriform, slightly curved; lid small, convex, apiculate.—*Hook. & Wils. t. xlvii.*; *Eng. Bot. t. 2855.*; (*Moug. & Nest. n. 831.*)

Tops of mountains of Scotland and Wales. Bearing fruit in autumn.

Forming broad, bright-green patches, reddish below. Distinguished from *W. annotina* by its broader leaves, differently-shaped sporangium, and geniculate slender sporangium. The stem is decumbent below the innovations, as in *Bryum*; leaves scarcely twisted when dry.

9. *W. albicans*, Schimp.; dioicous, tufted; stem erect or decumbent at the base; lower leaves distant, ovate, acuminate; upper lanceolate; nerve ceasing below the toothed apex; sporangium shortly pyriform; ring none; lid small; peristome large.—*Hook. & Wils. t. xlvii.*; *Eng. Bot. t. 1527, 2272, 2836.*; (*Moug. & Nest. n. 1125.*)

Wet banks, dripping rocks, etc. Bearing fruit late in the spring.

Forming loose glaucous patches. Stems  $\frac{1}{2}$ –1 inch long, reddish; male flowers subdiscoid. Sometimes confounded with small specimens of *Bartramia fontana*.

Distinguished from *W. carnea* by its loose habit, glaucous colour, and more ovate leaves.

10. **W. Tozeri**, *Schimp.*; dioicous; stem short, gregarious; lower leaves somewhat obovate; upper obovate, apiculate, more or less bordered; leaf-cells large; nerve reaching half-way; sporangium subpendulous; peristome rather small; lid conical.—*Hook & Wils. t. 1.*; *Grev. Sc. Crypt. Fl. t. 285.*

On shady banks, etc., by the side of rivulets. South of England and Ireland. Bearing fruit in spring.

Forming little reddish patches. Stems short, reddish, innovated above; leaves with a coloured border; leaf-cells large; male flowers gemmiform; cilia sometimes wanting.

Allied to *W. carnea*, but differing in the less crowded, red, margined leaves, the still looser reticulation, the shorter nerve, and smaller peristome.

### 57. **LEPTOBRYUM**, *Schimp.*

Peristome as in *Bryum*; innovations from the base; leaves very narrow; leaf-cells above hexagonal, elongated. *Annual Mosses, with slender stems, rooting only at the base.*

1. **L. pyriforme**, *Schimp.*; synoicous; lower leaves lanceolate, entire, scattered, upper spreading, elongated, subsetaceous, slightly toothed; nerve reaching to the tip; sporangium inclined or pendulous, pear-shaped; lid convex, mammillary.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 389.*; (Plate 18, fig. 3); *Moug. & Nest. n. 31.*

On sandstone rocks, sandy or turfy ground, etc., occasionally also in stoves. Bearing fruit in early summer.

Forming green, silky patches. Spore-sac small, attached to the walls of the sporangium by threads; lamina of the leaf very small, almost the whole being taken up by the nerve, the cells of which are very narrow.

58. **ORTHODONTIUM**, *Schwæg.*

Sporangium symmetrical; spore-sac small; peristome double; external of sixteen rather distant teeth, inner a membrane divided almost to the base into sixteen processes, without intermediate cilia. *Delicate, perennial, tufted Mosses, with very narrow leaves.*

1. **O. gracile**, *Schwæg.*; monoicous; leaves crowded, spreading, linear, setaceous, very obscurely toothed above; nerve reaching almost to the apex; sporangium inclined, elongated, clavate, with a long tapering apophysis; lid with a short beak.—*Hook. & Wils. t. xlvii.*; *Eng. Bot. t. 2835.*; (Plate 18, fig. 4.)

On sandstone rocks. Cheshire and Yorkshire.

Forming somewhat pulvinate, bright-green tufts. Leaves more or less waved; leaf-cells rather large; antheridia in the axils of the leaves; spore-sac separated from the walls of the sporangium; ring obsolete; peristome inserted deeply within the mouth; the outer teeth much more irregular than in *Bryum*, and not seen at all when the sporangium is dry; spores rather large, yellowish.

59. **AULACOMNION**, *Schwæg.*

Sporangium furrowed when dry; peristome almost as in *Bryum*; spores very small. *Perennial Mosses, growing in marshes or dry ground, and bearing terminal globular masses of gems.*

1. **A. androgynum**, *Schwæg.*; dioicous; leaves lineari-lanceolate, irregularly toothed at the apex; leaf-cells papillose on either surface; sporangium oblong, regular, slightly cernuous; male flowers gemmiform.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 1238.*; (*Moug. & Nest. n. 620.*)

On banks, trunks of trees, stones, etc. Bearing fruit, but rarely, in early summer.

Forming dense, pulvinate, bright-green tufts, which in the place of fruit frequently produce numerous cylindrical peduncles, surmounted by radiating, broadly fusiform, apiculate, 3-4-septate gemmæ; upper leaves more elongated; leaf-cells rotundo-hexagonal, projecting on either side, the walls evidently distinct from each other, and not confluent.

The gems were formerly taken for the male blossom, whence the erroneous name *androgynum*.

2. *A. palustre*, *Schwæg.*; dioicous; stems radiculose, irregularly dichotomous; leaves oblongo-lanceolate, erecto-patent, waved, twisted when dry, papillose, toothed at the apex; margin reflexed; sporangium oval, incurved.—*Hook. & Wils. t. xxviii.*; *Eng. Bot. t. 391.*; (Plate 18, fig. 5); *Moug. & Nest. n. 135.*

In boggy places, in meadows, on wood, etc. Bearing fruit in early summer.

Forming deep yellowish-green tufts. Stems matted together with rootlets; male flowers terminal, discoid. Globular tufts of abortive leaves or gemmæ borne on cylindrical stalks, are occasionally produced, but not so frequently as in the last species.

## 60. *TIMMIA*, *Hedw.*

Sporangium symmetrical; peristome double; outer of sixteen lanceolate teeth; inner a membrane divided halfway into about sixty-four filiform cilia, at first united above. *Perennial Mosses, with the habit of Polytrichum.*

1. *T. austriaca*, *Hedw.*; monoicous; stem elongated; leaves lineari-lanceolate, from a broad sheathing base; margin toothed; sporangium ovali-pyriform, striate; cilia even and entire.—*Hook. & Wils. t. xxxvi.*

Banks of the Isla, Forfarshire, Mr. Drummond. Bearing fruit on the Continent in summer.

Forming dense green tufts, 2 or 3 inches high, brown below. Leaf-cells below, rectangular, short, oblong, arranged in lines; above, shortly hexagonal.

The figure in the second edition of 'Muscologia Britannica,' as in Grev. Sc. Crypt. Fl. t. 326, seems to be taken from *T. megapolitana*, which differs in the cilia being appendiculate, and in the leaves not so decidedly sheathing at the base.

#### ORDER XVIII. *POLYTRICHIEI*, Brid. & Sch.

Sporangium often quadrangular, mostly closed by a flat central tympanoid membrane, which either connects the teeth or extends to the walls themselves; veil rough, with dependent hairs, rarely naked; leaves mostly rigid.

#### 61. *POLYTRICHUM*, *Brid.*

Dioicous. Sporangium angular, with a distinct apophysis; spore-sac undulated; peristome of sixty-four or more rarely of thirty-two short teeth, composed of several fibres, and united at the base by a narrow membrane; top of the columella forming a circular membrane uniting the teeth; veil densely clothed with silky hairs; nerve of leaves covered with longitudinal plaits.

1. *Sporangium mostly 5-6-angular; apophysis obscure.*

1. *P. sexangulare*, *Hoppe*; leaves rather short, spreading, incurved, often secund, elongato-lanceolate, from a broad base; margin thin, inflexed, mostly entire; sporangium hexagono-ovate, sometimes quadrate; fruitstalk thick; veil short; lid rostrate.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1906.*

On the tops of high mountains. Scotland. Bearing fruit in autumn.

Forming broad deep-green tufts. Stem 2–6 inches long; leaves obtuse, slightly toothed at the apex; veil clothed with rather short hairs; sporangium erect or cernuous, solid, generally 5–6-angled; apophysis obscure; teeth of peristome sixty-four, short; membrane cribose.

2. *P. gracile*, *Menz.*; leaves elongated, lineari-lanceolate, acute; margin thin, inflexed, sharply toothed; base sheathing; sporangium erect, on a long fruitstalk, hexagono-ovate; teeth of peristome irregular, springing from a very narrow membrane; veil shorter than sporangium; lid rostrate.—*Hook. & Wils. t. xlvi.*; *Eng. Bot. t. 1827.*; (*Moug. & Nest. n. 418.*)

In turbaries. Common. Bearing fruit in summer.

Forming dense tufts. Stems matted together with ferruginous rootlets; leaves shorter than in *P. formosum*, but with more marked lamellæ, larger leaf-cells, those at the base narrow and elongated, those above subquadrate; sporangium not quite covered with the down of the veil, soft; apophysis obscure.

3. *P. formosum*, *Hedw.*; stem elongated, simple; leaves spreading, lineari-lanceolate, from a pale sheathing base, acute, sharply toothed, plane; sporangium 4–6-angled, obscurely apophysate; lid conico-rostrate; veil large.—*Hook. & Wils. t. xlvi.*; *Eng. Bot. t. 1198.*; (*Moug. & Nest. n. 416.*)

In woods. Bearing fruit in summer.

Forming loose tufts, matted only at the base. Edge of lamellæ thickened; membrane of teeth more elongated; teeth regular. The indistinct apophysis, the larger lid, and the absence of distinct perichætil leaves, distinguish this from *P. commune*.

2. *Sporangium quadrangular*; *apophysis distinct*.

4. *P. piliferum*, *Schreb.*; stem simple; leaves elongato-lanceolate from a sheathing base, imbricated when dry,



suddenly larger towards the top of the stem, subrosulate, piliferous; margin reflexed, entire; nerve without lamellæ; sporangium ovate, quadrangular; apophysis distinct.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1199.*; (*Moug. & Nest. n. 128.*)

On dry exposed heaths. Bearing fruit in early summer.

Forming loose tufts. Primary stem branched at the base and densely clothed with rootlets; leaves entire, except the hair-point; peristome of sixty-four teeth, rather short, but rising from a distinct membrane.

5. *P. juniperinum*, *Hedw.*; stem simple or branched; leaves spreading, somewhat recurved, linear-lanceolate from a sheathing base; nerve excurrent, muricate behind; margin inflexed, entire; sporangium acutely quadrangular; lid rostellate.—*Eng. Bot. t. 1200.*; (Plate 18, fig. 7); *Moug. & Nest. n. 417 b.*

On heaths. Bearing fruit in early summer.

Forming dense, glaucous patches. Stems 1–6 inches long. Differs from the last in the shorter points of the leaves, and the shorter less distinct basal membrane of the teeth.

6. *P. strictum*, *Menz.*; stem branched; densely tomentose; leaves erecto-patent, straight, imbricated when dry, rather short; sporangium almost conical.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 2435.*; (*Moug. & Nest. n. 417 a.*)

In turbaries. Bearing fruit in early summer.

Forming dense tufts. Stems clothed with white down, varying much in length, sometimes a foot long.

7. *P. commune*, *L.*; stem simple, elongated; leaves very long, spreading, recurved, linear-lanceolate, from a sheathing submembranous pale shining base, toothed; lamellæ bifid; perichaetial leaves membranous; sporangium acutely quadrate; apophysis distinct; lid conico-rostellate.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1197.*; (*Moug. & Nest. n. 415.*)

In moist woods and turbaries. Bearing fruit in early summer.

Forming dense tufts, varying from 2 inches to a foot or more in length. Perichæatial leaves distinct; lamellæ covering almost the whole disk of the leaves; hairs of veil much longer than the sporangium.

Used for making hassocks. A short variety grows in dry spots.

## 62. POGONATUM, *P. Beauv.*

Dioicous. Sporangium oval or oblong, not angular; veil densely hairy; spore-sac in general attached to the walls of the sporangium; columella four-winged, or clothed with a plicate sporangial membrane; teeth thirty-two, united above to a tympanoid membrane; leaves densely lamellate.

1. *P. nanum*, *Brid.*; stem very short; leaves spreading, lanceolate from a sheathing base, minutely toothed at the apex; sporangium ovato-globose, solid, constricted when dry below the expanded mouth; columella even.—*Hook. & Wils. t. xi.*; *Eng. Bot. t. 1624, 1625.*; (Plate 19, fig. 1); *Moug. & Nest. n. 130.*

On heaths, sandy or loamy banks, etc. Bearing fruit in winter or very early spring.

Forming loose patches. Stems simple, without innovations; leaves rather obtuse, olive, at length reddish, erect when dry; fruitstalk more or less flexuous; lid broad, convex, with a short beak; columella without any waved covering; sporangium varying in outline; veil at first nearly white, at length tawny, shorter than the sporangium; teeth rather long.

2. *P. aloides*, *Brid.*; stem short, at length innovated; leaves elongated, lanceolate from a sheathing base, toothed; sporangium soft, oblong; columella winged; lid conical acu-

minate.—*Hook. & Wils. t. xi.*; *Eng. Bot. t. 1605, 1649, 1939.*; (Plate 19, fig. 2); *Moug. & Nest. n. 129.*

On heaths, moist banks, etc. Bearing fruit in winter.

Forming loose patches. Stems short, innovated at the apex; leaves spreading, erect when dry, toothed on the margin and back; teeth of peristome short.

Varying in the length of the stem and fruitstalk, but always distinguished from the last by its columella. *Eng. Bot. t. 1939,* is a variety with stems 2 inches or more long.

3. *P. urnigerum*, *Brid.*; stem branched; leaves spreading, imbricated when dry, linear-lanceolate from a sheathing base, toothed; sporangium erect, subcylindrical; lid convex, rostrate.—*Hook. & Wils. t. xi.*; *Eng. Bot. t. 1218.*; (*Moug. & Nest. n. 28.*) *Seta - urniger*

In mountainous woods, etc. Bearing fruit in winter and early spring.

Forming loose glaucous patches. Stems more or less branched, fastigiata; margin of lamellæ thickened. Mr. Wilson lays much stress upon the granulated surface of the sporangium, but I find the surface of *P. aloides* even more granulated.

4. *P. alpinum*, *Brid.*; caespitose; leaves spreading, recurved, linear-lanceolate from a sheathing base, concave, sharply toothed, spinulose at the back; sporangium more or less inclined, swollen, ovate or oblong and curved, lid with a long beak; teeth short, irregular.—*Hook. & Wils. t. xi.*; *Eng. Bot. t. 1905.*; (*Moug. & Nest. n. 219.*)

Stony ground in mountainous districts. Bearing fruit in summer.

Forming irregular tufts. Stems 2 or 3 inches long, branched above, mostly decumbent at the base; leaves elongated; lamellæ thickened, but not so abruptly; leaf-cells elongated at the

base, minute; sporangium more or less swollen, nearly quadrate above, extremely variable. The sporangium is represented in *Eng. Bot.* as somewhat angular, with a distinct apophysis.

### 63. OLIGOTRICHUM, DC.

Dioicous. Sporangium subcylindrical; veil with a few short erect hairs or papillæ at the apex; peristome single; teeth thirty-two, united at the base by a narrow membrane and above by a tympanoid membrane produced from the top of the columella which is clothed with the plicate sporangial membrane; leaves fleshy.

1. *O. hercynicum*, DC.; leaves spreading, incurved, rigid, lanceolate from a sheathing base; margin inflexed, remotely toothed; nerve lamellate in front, sulcate and spinulose behind; sporangium erect, oblong; lid conical, acuminate.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1219.*; (Plate 19, fig. 3); *Moug. & Nest. n. 725.*

On the *débris* of granite, etc., in alpine districts. Scotland, Wales and Lancashire. Bearing fruit in summer.

Stem scarcely an inch high; leaves fleshy, the margin inflexed but not thickened; nerve covered with undulated plates; veil sometimes quite naked.

### 64. ATRICHUM, P. Beauv.

Monoicous or dioicous. Sporangium subcylindrical; veil hood-shaped, almost naked, spinulose at the tip only; peristome single, of thirty-two teeth united at the base by a narrow membrane, and above by the tympanoid top of the columella; spore-sac adnate with the walls of the sporangium; leaves membranous.

1. *A. undulatum*, P. Beauv.; monoicous; stem simple or

dichotomous; leaves ligulato-lanceolate; margin undulated, sharply toothed; sporangium cylindrical, curved; lid with a long curved beak.—*Hook. & Wils. t. x.*; *Eng. Bot. t. 1220.*; (Plate 19, fig. 4); *Moug. & Nest. n. 131.*

In woods, on shady banks, etc. Common. Bearing fruit in winter.

Forming broad patches; margin of leaves thickened, and set with double teeth; nerve with a few narrow plaits; leaf-cells oblong below, subrotund or subquadrangle above; sporangia sometimes binate; lid almost as long as the sporangium. *Resembling in habit* *Mnium undulatum.*

2. *A. angustatum*, *Br. & Schimp.*; dioicous; stem shorter; leaves narrower, more densely reticulate, less hispid beneath; lamellæ numerous; sporangium narrow.—*Moug. & Nest. n. 932.*

On sandy ground. Hurst Pierpoint. Mr. Mitten. Schimper pronounces Mr. Mitten's plants, though barren, to be identical with the Continental species. It is a smaller and more delicate species, with shorter spines, and far smaller leaf-cells.

3. *A. tenellum*, *Br. & Schimp.*; dioicous; stem short, simple; leaves oblongo-lanceolate, scarcely undulated, even beneath; margin toothed beyond the middle; nerve slightly lamellate; sporangium subeunuous, obovate or oblong; veil obscurely hairy above; peristome large.—*Br. Eur. t. 412.*; (*Moug. & Nest. n. 1018.*)

On dried muddy places or clay. W. Wilson. Bearing fruit in autumn.

The very short stem, short sporangium, and other points, easily distinguish this species.

ORDER XIX. *BUXBAUMIETI*, Br. & Schimp.

Sporangium slipper-shaped, oblique, stalked or sessile; veil short, conical; peristome a conical membrane, surrounded by layers of cellular tissue divided into irregular teeth, or a rudimentary filmy ring.

65. *DIPHYSCIUM*, *Web. & Mohr.*

Sporangium nearly sessile, oblique, ovate, gibbous below; veil mitriform or cuculliform; spore-sac attached to the wall by threads; peristome a conical, rather twisted membrane with sixteen folds, thickened at the angles, surrounded by a very narrow filmy ring.

1. *D. foliosum*, *Web. & Mohr*; stem very short; leaves linear; veil mitriform.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 329*; (Plate 19, fig. 5); *Moug. & Nest. n. 37.*

On shady banks in subalpine countries, or on moist rocks.

Bearing fruit in summer.

  
size of plant.

Dioicous, or according to some authorities monoicous; occurring in broad patches. Plants more or less scattered, scarcely more than  $\frac{1}{4}$  of an inch high; leaves spreading, slightly incurved, more or less acute; nerve reaching nearly to the apex; perichaetial leaves divided above into jointed cilia; nerve excurrent; sporangium buried in the leaves; lid conical, acuminate. The leaves consist of two strata, the upper easily separating from the lower, and having smaller cells.

66. *BUXBAUMIA*, *Hall.*

Sporangium large, oblique, flat above, gibbous below, apophysate; veil small, cylindrico-campanulate; peristome a conical, plicate, membrane, slightly twisted when dry, surrounded by three or four layers of cellular tissue divided into irregular teeth; leaves rudimental.

1. *B. aphylla*, *Hall.* ; stem obsolete ; lower leaves roundish, deeply toothed, upper fringed ; sporangium plano-convex ; outer processes irregular, thick, and cellular.—*Hook. & Wils. t. xxii.* ; *Eng. Bot. t. 1596.* ; (Plate 19, fig. 6) ; *Moug. & Nest. n. 38.*

In woods and heaths. Rare. Scotland, Yorkshire, and Norfolk. It has been lately found in unusual abundance by Mr. Coutts near Aberdeen. Bearing fruit in May.

Dioicous, scattered. Stem a little bulb with minute hair-like leaves ; vaginula ovate, fleshy ; fruitstalk scabrous, an inch or more long ; sporangium reddish-brown ; spore-sac attached to its walls by threads ; lid conical, obtuse.

The other European species occurs on decayed wood, and has never been found in this country ; its outer teeth are more regular. The question whether these should be called an outer peristome or not, is one of great difficulty ; but we believe Mr. Wilson's view is the right one. It should be observed that the teeth of *Polytrichie* consist of several layers, and that these are disunited in *Dawsonia*. Schimper now considers the outer layers to represent the annulus, and between these and the inner plicate peristome, an outer delicate peristome to exist, more or less agglutinate with the annulus, and exceeding it. The part commonly called the annulus is merely the jagged edge of the sporangium.

#### ORDER XX. TETRAPHIDEI, Br. & Schimp.

Sporangium erect ; veil mitriform, plicate ; peristome united with the top of the columella which is divided into four pyramidal irregularly reticulated teeth.

#### 67. TETRODONTIUM, *Schwæg.*

Monoicous. Sporangium oval-oblong, regular ; veil sub-

mitriform, plicate; peristome of four short teeth; leaves minute, lineari-clavate, cylindrical at the base, flat above; perichæatial leaves faintly nerved.

1. **T. Brownianum**, *Schwæg.*; sterile branches none; perichæatial leaves ovato-acuminate, faintly nerved at the base; orifice of sporangium even.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 1422.*; (Plate 19, fig. 7); *Moug. & Nest. n. 811.*

On gritty, quartzose, or sandy rocks. Rare. Scotland and Ireland. Bearing fruit in July.

Stem very short; lower leaves analogous to ramuli, slightly thickened upwards, sometimes notched once or twice at the apex; lid obliquely rostrate, acute.

The top of the columella, which is adnate with the teeth, answers to the tympanum in *Polytrichie*; the veil resembles that of *Orthotrichum*; the teeth have not a definite number of striæ.

#### 68. **TETRAPHIS**, *Hedw.*

Monoicous. Sporangium subcylindrical, regular or slightly bent; veil mitriform, lacerated at the base; peristome of four triangular elongated teeth; leaves well developed; leaf-cells hexagonal.

1. **T. pellucida**, *Hedw.*—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 1020.*; (Plate 19, fig. 8); *Moug. & Nest. n. 14.*

On the ground on shady banks or in peat; sometimes on the roots of trees. Bearing fruit in autumn.

Forming dense green patches. Stems about an inch high, matted together at the base; leaves lanceolate or ovato-lanceolate, entire; nerve ceasing below the apex; stem often terminated by a cup-shaped cluster of leaves surrounding long-stalked, lentiform gems; fruitstalk an inch long; lid acute, conical.



ORDER XXI. *ZYGODONTEI*, Br. & Schimp.

Sporangium striated, pyriform; peristome none, single or double; veil hood-shaped, smooth. *Mosses with the habit of Gymnostomum.*

Differing principally from *Orthotrichei* in their smooth, hood-shaped veil.

69. *ZYGODON*, *Hook. & Tayl.*

Sporangium striate, apophysate, immersed or exserted; veil small, oblique, hood-shaped, smooth; peristome none, single or double, outer when present of thirty-two divisions united two or four together, so as to make sixteen or eight teeth; inner sixteen or eight eilia alternating with the teeth of the outer peristome. *Perennial tufted Mosses, with punctate leaves and plane, not revolute margins.*

1. *Stem tall, sporangium cylindrical.*

1. **Z. Forsteri**, *Wils.*; monoicous; stems densely tufted; leaves erecto-patent, acuminato-spathulate, hyaline below; sporangium pyriform, long-necked, striate; lid with a curved beak; outer teeth strongly recurved when dry.—*Hook. & Wils. t. xlvi.*; *Eng. Bot. t. 2225.*

Trunks of trees. South of England. Rare. Bearing fruit in spring.

Forming dense, succulent, green tufts. Stems matted with whitish rootlets; leaves dark-green above, pale towards the base, then red; outer teeth eight, yellowish; eilia hyaline, a little shorter.

2. **Z. conoideus**, *Hook. & Tayl.*; dioicous; loosely tufted; leaves spreading, curved upwards, linear-lanceolate, acuminate; nerve ceasing near the tip; sporangium oblongo-pyriform, striate; lid with a long beak; outer teeth trun-

cate, eight; cilia imperfect or fugacious.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 1239.*; (Plate 20, fig. 1); *Moug. & Nest. n. 721.*

On trunks of trees. Bearing fruit, but rarely, in May.

Less densely tufted than the last. Leaves narrower; leaf-cells smaller; fruitstalk longer; inner peristome often wanting. Male plants often mixed with the female. Leaf-cells above quadrato-punctiform, arranged in lines, more elongated and hyaline below.

## 2. *Peristome none.*

3. **Z. viridissimus**, *Brid.*; dioicous; more or less pulvinate; leaves spreading, recurved, subsquarrose, oblongo-lanceolate; sporangium obovate, costate when dry; lid with a long oblique beak.—*Hook. & Wils. t. vi.*; *Eng. Bot. t. 1583.*; (Plate 20, fig. 2); *Moug. & Nest. n. 1017.*

On trunks of trees or calcareous rock. Bearing fruit, but rarely, in spring.

Forming yellow-green tufts with fastigiate branches, or dense cushions. Leaves keeled, a little twisted, slightly curled when dry; leaf-cells very small, punctate; sporangium with eight obscure striæ; male plants growing in distinct tufts.

4. **Z. Mougeotii**, *Br. & Schimp.*; dioicous; tufted; leaves spreading, recurved, slightly twisted when dry, lineari-lanceolate; margin reflexed below; nerve reaching to the tip; fruitstalk short; sporangium turbinate, urceolate when dry, striated; lid rostrate.—*Hook. & Wils. t. xlvi.*; (*Moug. & Nest. n. 1016.*)

On moist, shady rocks. Bearing fruit, but rarely, in summer.

Forming soft, swelling tufts. Leaves elongated, not so

much crisped when dry as in *Z. lapponicus*, from which it differs, moreover, in its longer fruitstalk and beak.

This and *Z. lapponicus* constitute Schimper's genus *Amphoridium*, characterized by the short fruitstalk and crispate leaves. *Z. Mougeotii*, however, possesses neither character in a remarkable degree, and clearly connects *Z. viridissimus* with *Z. lapponicus*.

5. *Z. lapponicus*, *Br. & Schimp.*; monoicous; tufted; leaves spreading, crisped when dry, lineari-lanceolate, keeled; nerve ceasing below the tip; fruitstalk immersed; sporangium turbinate, urceolate when dry, 8-striate; beak short.—*Hook. & Wils. t. vi.*; *Eng. Bot. t. 2216.*; (Plate 20, fig. 3); *Moug. & Nest. n. 309.*

In the crevices of alpine rocks. Bearing fruit in summer.

Forming little loose or compact tufts. Stem  $\frac{1}{2}$ –2 inches long, a little tomentose; leaves strongly crisped when dry; leaf-cells extremely small, while those of *Z. Mougeotii* are far smaller than in *Z. viridissimus*.

6. *Z. gracilis*, *Wils. mss.*; tufted; leaves strongly keeled, suberect, nearly straight when dry, pellucid, strongly toothed above; nerve vanishing below the tip; leaf-cells rather large.

On walls. Malham. W. Wilson. Fruit unknown.

Tufted, from 1 to 2 inches high, radiculose. Leaves oblong, acute, strong and irregularly toothed; leaf-cells punctiform above, oblong below.

#### ORDER XXII. ORTHOTRICHIEI, *Br. & Schimp.*

Sporangium equal, mostly striated; veil mitriform, campanulate, plicate, generally covered with erect hairs; peristome variable; leaves keeled; margin often involute; cells punctiform, papillate.

70. **ORTHOTRICHUM**, *Hedw.*

Veil with a few keel-like folds; sporangium striate; peristome single, double, or wanting; leaves straight when dry, papillose and punctate above, loosely reticulated at the base and even.

\* *Peristome simple.*

1. **O. cupulatum**, *Hoffm.*; pulvinate; stem branched; leaves crowded, spreading, oblongo-lanceolate; sporangium obovate, with sixteen furrows; veil campanulate, more or less hairy.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 1423, 1325.*; (Plate 20, fig. 4); *Moug. & Nest. n. 723.*

On stones, trees, etc., especially in calcareous districts. Bearing fruit in spring.

Forming loose, pulvinate tufts of a dull-green. Veil sparingly hairy, in one variety nearly or quite naked; sporangium yellowish, with a short fruitstalk, with sixteen striæ, alternately longer and shorter, ribbed when dry; teeth sixteen with a strong medial line, sometimes showing at the base indications of another division, surrounded by a short lamellar appendage; cilia none; lid convex, with a short point.

2. **O. anomalum**, *Hedw.*; stem nearly simple, erect; leaves crowded above, erecto-patent, ovato-lanceolate, keeled; sporangium exserted, oblong, with sixteen striæ; peristome simple; veil hairy.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 2696.*; (Plate 20, fig. 5); *Moug. & Nest. n. 29.*

On rocks and walls, especially in calcareous districts. Bearing fruit in spring.

Monoicous; forming little tufts. Margin of leaves revolute or subrevolute; sporangium on a short but exserted stalk, reddish-brown, with light-coloured ribs, of which eight are long and eight short; teeth of peristome at first looking like eight only, with traces of an internal peristome; lid with a short beak.

Hedwig figures short intermediate striæ, which also appear in the 'English Botany' figure, and in Mougeot and Nestler's specimens. Wilson, however, gives the number as eight in his specific character. In some of his own specimens from the Orme's Head, the intermediate striæ are absent, but in others they are distinctly marked.

3. *O. Sturmii*, *Hoppe & Hornsch.*; monoicous; loosely tufted; stems erect or prostrate; leaves spreading and recurved when moist, incumbent when dry, keeled; margin revolute; sporangium immersed, obscurely eight-striate; veil more or less hairy.—(*Moug. & Nest. n.* 922.)

On stones and rocks. W. Wilson. Bearing fruit in summer.

Tufts dark-green. Larger than the last, with a more spreading habit; veil yellowish; peristome erect when dry.

\*\* *Peristome double.*

*a. Cilia eight.*

4. *O. obtusifolium*, *Schrad.*; dioicous, irregularly pulvinate; leaves spreading when moist, imbricated when dry, ovato-oblong, papillose beneath; tip obtuse, hyaline, minutely toothed; margin slightly incurved; veil naked below; sporangium immersed, eight-striate.—(*Moug. & Nest. n.* 616.)

On trees .W. Wilson. Bearing fruit, but rarely, in spring.

Tufts yellowish. Known by its obtuse leaves, whose margin is not recurved; veil orange, hairy at the tip only; mouth and ribs of the sporangium orange.

5. *O. fallax*, *Schimp.*; monoicous; stem short, dichotomous; leaves spreading, lanecolate or elliptico-lanceolate; sporangium immersed, swollen with an abrupt apophysis, 8-striate; veil campanulate, naked or with scattered hairs.—*Hook. & Wils. t.* xlv.; *Eng. Bot. t.* 2168.; (*Moug. & Nest. n.* 322.)

On trees. Rare. Ireland; Yorkshire. Bearing fruit in spring.

Forming little tufts or cushions. Leaves not papillose; leaf-cells rather large; teeth of peristome yellow, recurved when dry.

Schimper asserts that this is not the true *O. pumilum* of Swartz, and the names of *O. pumilum* and *fallax* were wrongly applied in the 'Bryologia Europæa.' Swartz's plant (Moug. & Nest. n. 925) has narrow cylindrical sporangia, while in the plant before us they are swollen.

6. *O. tenellum*; *Bruch*; monoicous; stems short, tufted; leaves spreading, loosely imbricated when dry, elongato-lanceolate, rather obtuse; veil rather long and narrow, with a few hairs; sporangium exserted, oblong, widely striate.—*Hook. & Wils. t. xlv.*

On trees. Rare. Ireland, Wales, Yorkshire, Derbyshire, and Sussex. Bearing fruit in early summer.

Sporangia golden-brown, with eight broad orange ribs; veil narrow, glossy; lid short, obtuse; teeth eight, rather incurved when dry.

7. *O. affine*, *Schrad.*; monoicous; stem erect, rather tall, dichotomously branched; leaves more or less spreading whether wet or dry, elongato-lanceolate, strongly papillose; margin reflexed; sporangium elliptico-oblong, with narrow striæ; veil mitriform, clothed with short scattered hairs.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 1323.*; (*Moug. & Nest. n. 323.*)

On trees and stones. Very common. Bearing fruit in summer.

Forming broad, loose, deep-green cushions. Veil pale-green; sporangia pale, on rather long fruitstalks, with eight narrow striæ, and when dry as many ribs; cilia eight, as long as the bigeminate teeth; spores large.

8. *O. fastigiatum*, *Bruch* ; monoicous ; densely tufted ; fastigiate ; leaves ovato-lanceolate, imbricated when dry, obscurely papillose ; fruitstalk rather short ; sporangium oblongo-pyriform, widely striate ; veil straw-coloured, hairy.—*Hook. & Wils. t. xlv.*

On trees in fields. North of England and Sussex. Bearing fruit in early summer.

The characters which distinguish this species are mostly comparative. The leaves are shorter and less acuminate, the texture looser, the base more hyaline, the papillæ more obscure, the fruitstalk short, the neck of the sporangium longer, more pyriform, the lid wider and more acuminate.

9. *O. speciosum*, *Nees v. Es.* ; monoicous ; stems elongated, loosely tufted ; leaves spreading, elongato-lanceolate, loosely imbricated when dry ; margin recurved ; sporangium exerted, subcylindrical, attenuated at the base, even or faintly striate ; lid ovato-campanulate, very hairy ; teeth bigeminate, reflexed when dry.—*Hook. & Wils. t. xxxiv.* ; *Grev. Sc. Crypt. Fl. t. 137.* ; (*Moug. & Nest. n. 722.*)

On trees. Scotland. Rare. Bearing fruit in summer.

Forming loose yellow-green tufts. Leaves waved, strongly papillose ; leaf-cells narrow and elongated at the base, larger and orbicular above and at the reflexed margins ; tip sometimes slightly eroded ; veil narrow ; sporangium pale, narrow, with eight faint striæ above.

10. *O. rupestre*, *Schleich.* ; monoicous ; loosely cæspitose, more or less elongated, rooting at the base ; leaves spreading, recurved, straight and imbricated when dry, elongato-lanceolate, keeled above ; veil villous ; sporangium pyriform, with eight faint striæ ; teeth sixteen, in eight pairs, erect when dry.—*Hook. & Wils. t. xxxiv.* ; *Grev. Sc. Crypt. Fl. t. 105.* (*Moug. & Nest. n. 825.*)

On rocks in alpine districts. Bearing fruit in summer.

Forming loose patches or tufts of a brownish tint. Leaf-cells narrow and elongated at the base, decreasing gradually upwards; fruitstalk mostly short; sporangium mostly with a short tapering apophysis, faintly striate; veil yellow, very hairy; teeth pale, at length quite distinct; spores small.

The figures quoted above and Mougeot and Nestler's specimens belong to a variety with straighter leaves, smaller sporangia, and less hairy veil.

*b. Cilia sixteen, alternately longer and shorter, small, rarely eight of equal length.*

11. **O. pallens**, *Bruch*; stem short; leaves oblongo-lanceolate, spreading; margin recurved below; lid conico-campulate, pale, naked; sporangium oblong, attenuated below, widely striate; lid short.—*Hook. & Wils. t. xlv.*; (*Moug. & Nest. n. 926.*)

On trees. Rare. Yorkshire, Mr. Spruce. Bearing fruit in June.

Leaves pale, hyaline below with oblong cells, papillose above, forming irregular soft bright-green tufts; fruitstalk very short; sporangium with a large apophysis, pale, with eight broad, deeper-coloured striæ; teeth eight, reflexed when dry; cilia sixteen or, according to Schimper, sometimes though rarely eight; veil naked.

12. **O. stramineum**, *Hornsch.*; stems elongated; leaves oblongo-lanceolate, spreading, loosely imbricated when dry, keeled, papillose; margin reflexed; sporangium oblongo-pyriform, with a short fruitstalk, widely striated; lid slightly hairy; cilia sixteen, rarely eight; vaginula hairy.—*Hook. & Wils. t. xlv.*; (*Moug. & Nest. n. 923.*)

On trees and boulders. Scotland, Wales, and England. Bearing fruit in summer.



Forming dense yellow-green cushions or patches. Veil straw-coloured with a brown tip, slightly hairy; sporangium yellow-brown, with very prominent orange striæ, cylindrical and contracted below the orifice when dry; interstices sometimes transversely wrinkled; lid short, blunt; teeth orange; cilia sixteen, nearly equal in length, rarely eight; base of leaves hyaline with oblong cells, which are almost confined to the disk; tip often slightly eroded.

13. *O. Sprucei*, *Mont.*; monoicous; stems short, tufted; leaves slightly spreading, erect and imbricated when dry, oblongo-spathulate or oblong, apiculate, flaccid, obscurely nerved; margin nearly plane; sporangium pyriform, widely striate; veil naked; lid short, subconical; teeth in eight pairs; cilia sixteen or eight.—*Hook. & Wils. t. xlv.*

On trees near rivers. Occasionally from the Clyde to the Thames. Bearing fruit in early summer. Not found at present on the Continent.

Forming short tufts. Stems sparingly branched; leaf-cells large, not papillose; sporangium half immersed.

The leaves in this curious species have no tendency to be lanceolate; the apex is rather blunt, with a little apiculus; the margin is widely reflexed; the leaf-cells are much larger than in most species, not papillose, and those at the base do not differ greatly from the others in length; the nerve in the lower leaves reaches scarcely above the middle and vanishes below the apex in the upper.

14. *O. rivulare*, *Turn.*; stems elongated, decumbent, or pendulous; leaves spreading, flaccid, loosely imbricated when dry, ovato-lanceolate, obtuse; margin recurved; sporangium pyriform, widely striate; veil naked; teeth in eight pairs, reflexed when dry; cilia sixteen.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 2188.*; (*Moug. & Nest. n. 824.*)

On rocks and roots of trees near rivers in alpine countries. England, Ireland, and Wales. Bearing fruit in spring.

Forming loose, dull, dark-green tufts, often floating. Stems branched; leaf-cells minute, papillose; lid shortly rostrate.

Easily distinguished from the last by its minute reticulations as well as by its larger size.

*c. Teeth eight, soon broken up into sixteen; cilia sixteen, as long as the teeth.*

15. *O. diaphanum*, *Schrad.*; short, loosely tufted; leaves erecto-patent, loosely imbricated when dry, ovato-lanceolate, acuminate, with a diaphanous, often toothed, almost hair-like apex; margin revolute; sporangium oblongo-pyriform, substriate; veil mostly naked.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 1324.*; (Plate 20, fig. 6); *Moug. & Nest. n. 325.*

On trees, stones, etc. Common. Bearing fruit in early spring.

Forming bright-green soft tufts. Leaf-cells large, very obscurely marked at the diaphanous tips; fruitstalk short; sporangium sometimes very obscurely ribbed when dry; lid shortly rostrate.

16. *O. pulchellum*, *Sm.*; short, tufted; leaves spreading, suberect and slightly crisped when dry, soft, linear-lanceolate; margin revolute; fruitstalk elongated; sporangium oval, striate; lid naked; teeth reflexed when dry.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 1787.*; (Plate 20, fig. 7).

On trunks of trees and stones. Bearing fruit in spring.

Forming little pale-green tufts. Leaves tender, slightly waved; leaf-cells above beautifully arranged in lines, punctiform; sporangia red, with eight reddish streaks, ribbed when dry; teeth sixteen, with sixteen cilia.

*d. Teeth sixteen; cilia sixteen of a double series of cells, eroded at the sides, minutely papillose.*

17. *O. leiocarpum*, *Br. & Schimp.*; stems rather tall, loosely tufted; leaves spreading, recurved, erect or patent when dry; lanceolate; margin revolute; fruitstalk very short; sporangia large, obovate, soft, even; veil hairy.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 2187.*; (Plate 20, fig. 8); *Moug. & Nest. n. 324.*

On trees, pales, and stones. Bearing fruit in spring.

Forming green tufts or patches. Sporangium immersed, ovate, with a short neck, pale-yellow, without striæ, even and slightly contracted below the orifice when dry; lid shortly rostrate; teeth often bifid, revolute when dry; cilia deeply eroded; spores ferruginous.

This is the old *O. striatum*, a very inappropriate name in the present condition of the genus, inasmuch as it is the only European species with an even sporangium. It applied, however, originally to the veil, not to the sporangium.

18. *O. Lyellii*, *Hook. & Tayl.*; dioicous; stems elongated, pulvinate; leaves almost squarrose, flexuous, erect, twisted when dry, linear-lanceolate; fruitstalk exserted; sporangium oblongo-pyriform, striate; veil hairy; cilia broad, carinate.—*Hook. & Wils. t. xxii.*; *Eng. Bot. t. 2834.*; (*Moug. & Nest. n. 619.*)

On trunks of trees. Rare. Bearing fruit in summer.

Forming large, yellowish-green, loose tufts. Stems matted below with rootlets; leaves clothed with cylindrical papillæ and brown confervoid threads; vaginula slightly hairy; lid shortly rostrate; cilia sixteen, red, subtrabeculate, eroded at the margin; spores large, green.

Schimper gives as follows what he believes to be the affinities of the species:—

1. *O. obtusifolium*.
2. *O. affine, fastigiatum, pallens, tenellum, fallax, stramineum*.
3. *O. speciosum*.
4. *O. diaphanum*.
5. *O. leiocarpum, Lyellii*.
6. *O. pulchellum*.
7. *O. Sprucei, rivulare*.
8. *O. cupulatum, Sturmii, rupestre, anomalum*.

### 71. ULOTA, Mohr.

Sporangium and peristome as in *Orthotrichum*; veil multiply, hairy; leaves more or less crisped when dry; leaf-cells at the base narrow; ocrea indistinct.

*a. Peristome single, or inner very obscure.*

1. **U. Drummondii**, *Brid.*; stem creeping; branches erect; leaves ovate at the base, linear-lanceolate, slightly crisped when dry; margin nearly plane; sporangium exserted, oblongo-pyriform, obliquely striate.—*Hook. & Wils. t. xxxiv.*; *Grev. Sc. Crypt. Fl. t. 115*.

On trunks of trees, especially birch. Scotland, Ireland, and Yorkshire. Bearing fruit in autumn.

Forming yellowish-green tufts, with creeping matted stems. Fruitstalk twisted; teeth sixteen, spreading when dry, often united in pairs at the tip; lid acicular.

2. **U. Ludwigii**, *Brid.*; stem creeping; leaves linear-lanceolate, spreading, slightly twisted when dry; sporangium exserted, clavato-pyriform, striate above, plicate when dry, and much contracted at the orifice; veil hairy.—*Hook. & Wils. t. xxxiv.*; *Grev. Sc. Crypt. Fl. t. 133.*; (*Moug. & Nest. n. 617*).

On trees, especially young Oaks, in alpine glens. Scotland and Ireland. Bearing fruit in autumn.

Forming yellow-green tufts. Teeth erect when dry; extremely slender, short cilia or irregular laciniaë are sometimes present.

*b. Peristome double.*

3. **U. Hutchinsiaë**, *Schimp.*; stem erect, branched; leaves erecto-patent, imbricated and nearly straight when dry, lanceolate; margin very slightly reflexed; sporangium clavato-pyriform, striated; veil hairy.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 2523.*; (*Moug. & Nest. n. 618*).

On rocks in alpine districts. Wales, Ireland, and Scotland. Said also to be found in Devonshire. Bearing fruit in summer.

Forming rather rigid dark-green tufts. Stem brittle; sporangium more or less pedicellate; fruitstalk twisted; lid rostrate; outer peristome of eight bigeminate teeth; cilia eight, short, in one variety obsolete.

This recedes from the characters of the genus as far as regards the crispature of the leaves, but the basal cells are narrow. The margin is often quite plane above.

4. **U. Bruchii**, *Brid.*; pulvinate; stem decumbent or erect; leaves spreading, linear-lanceolate, from an ovate concave base, crisped when dry; sporangium on a long fruitstalk, oblongo-pyriform, widely striated, when dry contracted above; veil very hairy.—*Hook. & Wils. t. xlv.*; (*Moug. & Nest. n. 826*).

On trees. Scotland, Westmoreland, Yorkshire, and Sussex. Bearing fruit in autumn.

Monoicous; forming yellowish-green cushions. Fruitstalk twisted; sporangium almost fusiform when dry; teeth sixteen, reflexed when dry; cilia sixteen or eight; leaves twisted when dry, but not so much as in *U. crispa*. A very beautiful species.

5. **U. crispa**, *Brid.*; soft, pulvinate; leaves linear-lanceo-

late from a concave ovate base, keeled, subflexuous, when dry much twisted and crisped; sporangium clavate, with a long tapering apophysis, widely striate, contracted below the orifice; veil very hairy.—*Hook. & Wils. t. xxi.*; *Eng. Bot. t. 996.*; (*Moug. & Nest. n. 30*).

On trees. Common. Bearing fruit in autumn.

Forming little yellow-green soft cushions. Stem elongated; sporangium rising from a short fruitstalk which is confluent with the long apophysis; teeth eight, bigeminate; cilia eight, or occasionally sixteen, lanceolate, with a medial line.

6. *U. crispula*, *Schimp.*; tufted; stems short, branched; leaves linear-lanceolate, crisped when dry; sporangium clavato-pyriform, with eight narrow ribs; veil very hairy.—*Hook. & Wils. t. xlv.*; (*Moug. & Nest. n. 827*).

On trees. Rare. North and south of England. Bearing fruit in May and June.

Forming soft pale tufts; leaves narrower, thin, delicate, less crisped when dry; fruitstalk twisted; lid rostrate; sporangium not contracted below the orifice; apophysis shorter. It is far more delicate, and ripens its fruit earlier than *U. crispa*.

7. *U. phyllantha*, *Brid.*; pulvinate; leaves linear-lanceolate, elongated, suberect, straight, crisped when dry, apex gemmiparous.—*Hook. & Wils. t. xlvi.*

On rocks near the sea. Wales, Yorkshire, and Sussex. Not yet found in fruit.

Forming dense ferruginous-green tufts. Leaves narrower than in *U. crispa*, much twisted and curled when dry; nerve produced to the tip, and there thickened, and bearing cylindrical articulated gemmæ.

Differs from *U. crispa* in the less spreading longer gemmi-

ferous leaves which are not dilated below. The diaphanous cells moreover are absent at the base, with the exception of a single row at the margin. I have not had an opportunity of examining this species myself.

ORDER XXIII. *PTYCHOMITRIEI*, Br. & Schimp.

Sporangium without a tapering apophysis, adnate with the walls; veil smooth, furrowed, its apex subulate; primary teeth not more than sixteen; leaf-cells punctiform, not papillose; ocrea wanting.

72. *PTYCHOMITRIUM*, Br. & Schimp.

Sporangium regular, slightly tapering below, but without any apophysis; veil mitriform, deeply furrowed, subulate above, lacinate below; peristome single, of sixteen inarticulate deeply-divided teeth; leaf-cells of the upper half and margin subquadrato-punctiform, arranged in lines, of the disk and of the lower half narrow elongated.

1. *P. polyphyllum*, Br. & Schimp.; tufted; leaves spreading, linear-lanceolate, ovate at the base, crisped when dry, toothed at the apex, acute; sporangium elliptic.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1217.*; (Plate 21, fig. 1); *Moug. & Nest. n. 410.*

Rocks and walls in alpine or subalpine districts. Common. Bearing fruit in spring.

Forming loose dense tufts. Leaves keeled; nerve reaching to the toothed apex; leaf-cells nearly as in *Ulota*. Fruit abundant; fruitstalk elongated; lid subulate; sporangium pale; teeth sixteen, deep-red, deeply cleft, inarticulate; lid subulate.

73. **GLYPHOMITRIUM**, *Schwæg.*

Sporangium roundish; veil large, ventricose, plicate, at length laciniate, rostrate above; peristome single, of sixteen teeth, disposed in pairs, and inserted below the rim of the sporangium with numerous prominent transverse bars.

1. **G. Daviesii**, *Schwæg.*—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1281.*; (Plate 21, fig. 2).

On rocks, chiefly near the sea, as at the Giant's Causeway. Bearing fruit in summer. Not found on the Continent.

Forming little dense, short, dark-green tufts, about  $\frac{1}{2}$  an inch high. Leaves spreading, narrow, linear-lanceolate; leaf-cells quadrato-punctiform above and on the slightly thickened margin, gradually longer downwards, and still rectangular; fruitstalk short; sporangium erect, roundish; lid rostrate, nearly as long as the sporangium, from a flattish base; teeth in pairs, trabeculate externally, reddish; spores large; veil swollen below and laciniate, acicular above.

ORDER XXIV. **GRIMMIEI**, *Br. & Schimp.*

Sporangium equal, often sessile; peristome single; veil mitriform; leaves dark-green, mostly terminated by a white hair-like point; leaf-cells of the upper part of the leaves hexagono- or quadrato-punctiform.

74. **RACOMITRIUM**, *Br. & Schimp.*

Sporangium erect, regular; veil mitriform, even, multifid at the base, subulate at the tip which is papillose; ring large; peristome single, of sixteen bi-trifid teeth, divided sometimes to the base, very long or rather short, unequal and irregularly cohering; vaginula with an ocrea at the summit; leaf-cells quadrate above, elongated and often sinuous below, rarely almost uniform throughout.



1. *Branchlets or innovations not fastigate.*

1. **R. canescens**, *Brid.*; stem erect, much branched; branchlets short, obtuse, remote; leaves spreading and recurved, ovato-lanceolate, rough with acuminate, crenulate, diaphanous points; fruitstalk long; sporangium ovate, somewhat striate when dry; lid long, subulate; teeth long, nodulose, bipartite.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1991, 2534.*; (*Moug. & Nest. n. 20*).

On sandy ground on heaths and mountains. Bearing fruit early in spring.

Forming large yellowish-green patches, which are hoary from the diaphanous points. Leaves subsulate, rough with short almost spinulose papillæ; margin recurved; fruitstalk 1 inch long, twisted when dry; sporangium obscurely furrowed; teeth of peristome red. There are a few large rectangular leaf-cells at the basal edges of the leaves.

2. **R. lanuginosum**, *Brid.*; stem decumbent, elongated; branches fasciculate; leaves slightly spreading, lanceolate, their hair-like diaphanous tips eroded or subeiliate; fruitstalk short; sporangium small, ovate; teeth long, slender, bipartite.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1348.*; (*Moug. & Nest. n. 21*).

On the tops of mountains, also on walls and rocks. Bearing fruit early in spring.

Forming extensive soft, swollen, hoary patches. Stem sometimes a foot long, irregularly branched, sometimes sub-pinnate; leaves ovate below, varying in length, minutely papillose except at the top; margin slightly recurved; fruitstalk rather rough, short; veil rough at the tip; ring broad; teeth of peristome very slender, bipartite, nodulose.

I do not find the large cells at the base as in the last species, though those of the extreme edge are rectangular.

3. *R. microcarpon*, *Brid.*; stems slender, fasciculate; branches short; leaves crowded, spreading, curved or subsecund, lanceolate, keeled, tapering into a short, diaphanous, toothed point; fruitstalk short; sporangium small, oblong; teeth of peristome short.—*Hook. & Wils. t. lxi.*; *Moug. & Nest. n. 1009.*

On rocks in dry places. Highlands of Scotland. Rare. Bearing fruit in autumn.

Forming pale or yellow-green, slightly glaucous tufts. Branches short; leaf-cells everywhere elongated and sinuous, very minutely papillose; diaphanous point very short; walls of sporangium thin.

Mougeot and Nestler's plant seems to be right, but they state that it perfects its fruit in spring, like *R. fasciculare*.

4. *R. fasciculare*, *Brid.*; stem elongated, decumbent; branches fasciculate, ramulose; leaves spreading, recurved or incurved, linear-lanceolate, from a narrow tapering base; tip scarcely hyaline; margin reflexed; veil papillose; sporangium elliptic; lid subulate; teeth slender, nodulose, bipartite; ring large.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 2005.*; (*Moug. & Nest. n. 916*).

On wet rocks. Bearing fruit in spring.

Forming loose patches of a lurid green. Stem decumbent; innovations erect, varying in length; leaves lanceolate, tapering to an acute but green point; margin recurved; leaf-cells elongated, narrow and sinuous, minutely papillose; veil strongly papillose; teeth very slender; walls of sporangium thick; teeth red, nodulose, divided to the base.

5. *R. heterostichum*, *Brid.*; stems elongated, prostrate at the edge of the patches, erect in the centre; leaves erectopatent or subsecund, subplicate, lanceolate, tapering into diaphanous points; margin recurved; sporangium subcylindrical,

small-mouthed; veil papillose at the tip; lid shorter than the sporangium; teeth of peristome short, irregularly cloven, incurvo-patent when dry.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1347.*; (Plate 21, fig. 4); *Moug. & Nest. n. 119.*

On rocks and walls, generally in dry places. Bearing fruit in spring.

Forming low hoary patches. Stem slightly branched; leaves darkish-green; margin recurved; leaf-cells above, except at the hyaline tips, subquadrate, below sinuous and narrow, minutely papillose, those at the extreme margin below larger and rectangular; some of the basal cells without papillæ; veil papillose at the apex; lid shorter than in the preceding species; teeth short, bifid, the divisions irregular, sometimes combined at the tips.

2. *Branchlets dichotomous; innovations fastigate.*

6. **R. sudeticum**, *Br. & Schimp.*; loosely tufted; stems elongated, somewhat fasciculate; leaves spreading from an erect base, recurved or incurved, lanceolate, with a short, diaphanous, slightly toothed point, keeled; fruitstalk short; sporangium small, ovato-oblong; lid shortly rostrate.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1440.*

On exposed alpine rocks. Bearing fruit in spring.

Forming loose, olive-green, hoary tufts. Stem prostrate at the base, then ascending; margin of leaves reflexed; veil nearly even; lid shorter than the sporangium, falling off with the veil; ring broad, dissilient; teeth bipartite, varying in length, but tolerably regular, sometimes trifid; upper leaf-cells quadrate, lower narrow.

7. **R. protensum**, *Braun*; dioicous; tufted; stem ascending; leaves spreading or secund, linear-lanceolate, from an oval or oblong base, acuminate, but rather blunt; apex not diaphanous; sporangium elliptic-oblong, soft; teeth rather

short, irregularly cloven.—*Hook. & Wils. t. xlv.*; (*Moug. & Nest. n. 215*).

On moist rocks near alpine rivulets. Wales, Yorkshire, and Derbyshire. Bearing fruit in spring.

Forming wide, depressed, yellowish-green tufts. Leaves slightly plicate below; margin reflexed; fruitstalk about  $\frac{1}{2}$  an inch long; veil multifid; lid conico-subulate; teeth incurved when dry.

8. *R. aciculare*, *Brid.*; dioicous; loosely tufted; stems elongated, ascending; leaves spreading or secund, ovato-oblong, obtuse, toothed or entire at the tip; nerve ceasing below the apex; sporangium ovato-oblong; mouth small; lid subulate; teeth deeply bi-trifid.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1978.*; (Plate 21, fig. 3); *Moug. & Nest. n. 22.*

On wet rocks. Bearing fruit in winter and early spring.

Forming dull-green patches. Leaves broader and much more obtuse than in the last; leaf-cells quadrate above, elongated below, minutely papillose; margin recurved.

9. *R. ellipticum*, *Br. & Schimp.*; dioicous; stem rigid, brittle; leaves spreading from an erect base, suberect when dry; margin plane, slightly thickened; nerve nearly reaching to the tip; fruitstalk short and thick; sporangium ovato-globose, hard, even; lid acicular.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1901.*

On moist granite, schist, or mica. Scotland, Wales, and Ireland. Bearing fruit in winter and spring.

Forming dark-green or blackish tufts. Stem about 1 inch long, decumbent below; teeth of peristome lanceolate, bi-trifid.

Allied to *Grimmia atrata* and *concolor*, from which it differs in the form of the veil.

10. *R. patens*, *Schimp.*; dioicous; caespitose; leaves spread-

ing every way, rarely subsecund, suberect when dry, elongato-lanceolate, blunt; margin revolute; nerve with two lamellæ at the back; fruitstalk curved; sporangium oval, furrowed when dry; ring large; teeth long and bifid.—*Hook. & Wils. t. xix.*; *Eng. Bot. t. 1990.*; (*Moug. & Nest. n. 214*).

On moist, quartzose, mostly alpine rocks. Bearing fruit in April and May.

Forming olive-green or brownish depressed patches. Stem 2–4 inches long, decumbent at the base, and naked; leaf-cells narrow and sinuous; fruitstalk rather short; veil mostly five-lobed below; teeth long, at first united above, barred.

This species agrees with *Racomitrium* in all except the curved fruitstalk, and is, I think, rightly associated with it by Schimper. The cells are minute and sinuoso-quadrangle above, oblong and rectangular below, exactly as in *R. sudeticum*.

### 75. GRIMMIA, *Ehr.*

Sporangium erect or more or less pendulous, on a straight or curved fruitstalk; veil mitriform or cucullate; peristome single, of sixteen rather large, lanceolate, externally trabeculate, bi-trifid teeth, rarely wanting; columella not deciduous, shrinking into the ripe sporangium; leaf-cells dot-like, larger and diaphanous below.

1. *Fruitstalk straight.*

a. *Veil lobato-cucullate.*

1. *G. atrata, Mieliich.*; dioicous; pulvinate, erect; leaves erecto-patent, curved, twisted when dry, linear-lanceolate, elongated, keeled; margin reflexed; sporangium suberect, elliptico-oblong; ring large; lid conical; veil submitriform.—*Hook. & Wils. t. xliv.*; *Eng. Bot. t. 2771, f. 1.*

On moist schistose rocks. Wales and Scotland. Rare. Bearing fruit in winter and early spring.

Forming dense blackish tufts 2 or 3 inches high. Tips of branches dingy green; leaves not hair-pointed; fruitstalk rather thick, erect or slightly cernuous; teeth pierced above or split halfway; leaf-cells at the base rather sinuous; veil between mitriform and cucullate; lid conical or very slightly rostrate.

The figure of the veil is very different in the two plates quoted above.

2. *G. unicolor*, *Grev.*; dioicous; loosely cæspitose; stems fastigate; leaves erecto-patent, erect when dry, elongated, linear-lanceolate, obtuse; margin incurved; nerve broad, reaching to the tip; sporangium suberect, ovate; ring large; lid rostrate.—*Hook. & Wils. t. xxxiii.*; *Eng. Bot. t. 2771, f. 2.*; *Grev. Sc. Crypt. Fl. t. 123.*

On alpine rocks. Clova, Mr. Drummond. Bearing fruit in autumn.

Forming loose lurid patches. Leaf-cells at the base strictly quadrate or rectangular, much looser than in the last; stems less robust; leaves more obtuse; veil mitriform or cucullate, multifid at the base; teeth entire, bifid or perforated. The leaves are not carinate as in the last, and the lid is longer.

*b. Veil conico-mitriform.*

3. *G. leucophæa*, *Grev.*; dioicous; tufted; stem erect; upper leaves spreading, ovate or ovato-oblong, hair-pointed, closely imbricated when dry; margin plane; sporangium shortly exserted, erect, elliptic or oblong; ring large; lid shortly conico-rostrate; teeth perforated and bifid.—*Hook. & Wils. t. xxxiii.*; *Grev. Sc. Crypt. Fl. t. 284.*; (*Moug. & Nest. n. 813*).

On trap rocks. Scotland and Devonshire. Bearing fruit in early spring.

Forming dense hoary tufts. Stem short; lower leaves blunt; hair-points rough, diaphanous; veil lobed at the base; lid varying in length; teeth moderately broad, deeply bi-trifid, perforated, with many transverse bars; leaf-cells punctiform above, except at the hair-point, where they are narrow, elongated, subhexagonal, and apparently not on the same plane, being derived from the nerve; those of the basal disk shortly rectangular.

4. *G. ovata*, *Web. & Mohr*; monoicous, tufted, more or less elongated; leaves spreading, erect when dry, lanceolate, hair-pointed; margin recurved below; sporangium exserted, firm, oval; ring large, dehiscent; lid shortly rostrate; teeth narrow, bifid.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 2165, in part*; (*Moug. & Nest. n. 311*).

On alpine rocks, ascending very high on the Continent. Scotland, Wales, and Leicestershire. Not common. Bearing fruit from autumn to early spring.

Forming short, dense, or lax, greyish tufts; lid oblique; divisions of teeth unequal; inflorescence sometimes synoicous; leaves of a firm texture, bright-green; leaf-cells in the disk of the lower half rectangular.

5. *G. Donniana*, *Smith*; pulvinate, short; leaves elongato-lanceolate, hair-pointed; margin plane; sporangium erect, slightly exserted, oval-oblong; walls thin; lid short, conical, obtuse; ring small, persistent; teeth entire or perforated.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1259 and 2165 in part*.

On rocks and stones in alpine districts. Scotland, Wales, and Derbyshire. Bearing fruit at the beginning of summer.

Forming little, short, hoary cushions. Sporangia with a thin, not firm wall as in the last, of a paler tint, a shorter lid,

and more entire teeth, much more transparent below, and all the basal leaf-cells, with the exception of those of the nerve, rectangular.

2. *Fruitstalk arched.*

6. **G. Schultzii**, *Brid.* ; monoicous ; tufted ; leaves crowded, lanceolate, subsecund, hair-pointed ; margin recurved ; fruit-stalk curved, short ; sporangium broadly elliptic or obovate, furrowed ; ring very large ; teeth long, deeply bifid.—*Hook. & Wils. t. xlv.*

On subalpine, generally quartzose rocks. Scotland, Wales, and Cornwall. Bearing fruit in spring.

Forming loose, irregular, dark cushions. Stems rather robust but short, suberect ; diaphanous hair-point of leaves very rough ; fruitstalk swan-necked ; teeth brittle, very long and slender ; leaf-cells of the angles quadrate or rectangular, of the dorsal disk narrow, those above minute except at the diaphanous sides of the excurrent nerve.

7. **G. trichophylla**, *Grev.* ; dioicous ; loosely tufted ; leaves spreading, lax, assurgent, curved when dry, linear-lanceolate, hair-pointed ; margin recurved ; fruitstalk curved ; sporangium elliptic, furrowed ; ring large ; teeth bifid.—*Hook. & Wils. t. xxxii.* ; *Grev. Sc. Crypt. Fl. t. 100.* ; (*Moug. & Nest. n. 814*).

On stone walls in subalpine districts. Fruit in spring.

Forming loose, yellow-green cushions. Fruitstalk when dry nearly erect ; sporangium with eight furrows ; teeth rather long ; leaf-cells as in the last.

8. **G. Hartmannii**, *Schimp.* ; cæspitose ; stem elongated, procumbent, rigid ; leaves elongato-lanceolate, very shortly hair-pointed, sharply keeled above, spreading when dry.

On quartzose rocks. Conway, W. Wilson. Perfect fruit unknown in this country, as also on the Continent.



Allied to the last, but with a short hair-point, and denser sinuated reticulations at the base.

9. *G. torta*, *Hornsch.*; densely pulvinate, soft, flexible; leaves erecto-patent, spirally curved round the stem when dry, lanceolate, keeled, acuminate, the lower pointless, the upper very shortly hair-pointed.—*Hook. & Wils. t. xxxii.*; *Grev. Sc. Crypt. Fl. t. 199.*

On alpine rocks. Always barren, both in this country and on the Continent.

Forming dense tufts, bright-green above, 1–2 inches high, dark below, the individual plants easily separating from each other. Leaves three-ranked, channelled above along the nerve, sometimes but not always hair-pointed; margin slightly reflexed; leaf-cells larger at the angles, on the disk narrow, subquadrate or punctiform upwards. The arrangement of the leaves when dry calls to mind *Hypnum trifarium*.

10. *G. spiralis*, *Hook. & Tayl.*; dioicous; pulvinate; stems slender; leaves lanceolate, hair-pointed, erecto-patent, spirally imbricated when dry; fruitstalk curved; sporangium small, ovate, nearly even; lid short, obtuse; ring broad.—*Hook. & Wils. t. xxxii.*; *Grev. Sc. Crypt. Fl. t. 203.*

On exposed alpine rocks. Ireland, Scotland, and England. Bearing fruit in autumn.

Forming large dense cushions. Stems easily separating as in the last species; margin of leaves recurved; sporangium with eight obscure furrows or quite even; veil lobed at the base; teeth bifid, recurved when dry; leaf-cells as in the last, except that those at the angles are very large.

11. *G. orbicularis*, *Br. & Schimp.*; monoicous; densely tufted; leaves crowded, oblongo-lanceolate, hair-pointed; sporangium roundish, faintly striate; fruitstalk curved; lid

short, mammillary; ring narrow; teeth pale-red, perforated, trifid, distinctly barred; veil cucullate.—*Hook. & Wils. t. xlv.*; *Eng. Bot. t. 2888.*; (*Moug. & Nest. n. 910.*)

On calcareous rocks and walls. North Wales and Bristol. Bearing fruit in spring.

Differing from *G. pulvinata*, which sometimes has a similar lid, in its large compact tufts, longer stems, broader leaves, cucullate veil, yellow fruitstalk, and subspherical, smaller, red sporangium, which is even except when dry. The leaf-cells at the angles are large as in the last species.

12. *G. pulvinata*, *Smith*; monoicous; pulvinate; leaves elliptico-lanceolate, suddenly attenuated and hair-pointed, keeled; margin recurved; sporangium oval, furrowed; fruit-stalk curved; veil mitriform, lobed at the base; lid rostrate; ring large, dehiscent; teeth red, densely barred.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1728.*; (Plate 21, fig. 5); *Moug. & Nest. n. 710.*

On walls, stones, etc. Very common. Bearing fruit a month later than the last.

Forming glaucous-green cushions, but not so compact or so thick as in the last. Leaves broader; sporangium distinctly striate; teeth longer, more or less spreading, and not converging when dry. A variety occurs with a shorter stem, a blunter lid, and more perforated jagged teeth.

## 76. SCHISTIDIUM, *Br. & Schimp.*

Sporangium immersed; veil mitriform, multifid at the dilated base; columella adhering to the lid and falling away with it; peristome single, of sixteen lanceolate teeth, barred transversely without any medial line, often more or less perforated above.

Schimper, in his Synopsis, reduces all again to a subgenus of *Grimmia*.

1. *S. maritimum*, *Br. & Schimp.*; pulvinate; leaves much crowded, erecto-patent, straight, incurved when dry, narrow, lanceolate, with a strong excurrent nerve; sporangium obovato-truncate; lid very large, shortly rostrate from a convex base; ring none; teeth cribose.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1645.*

On rocks near the sea, principally those which are quartzose, very rarely on those which are calcareous. Bearing fruit in spring.

Monoicous; forming lurid or sometimes olive-yellow cushions, about an inch high. Leaves rigid, strongly acuminate, but not hair-pointed; margin slightly reflexed at the base; teeth of peristome large.

2. *S. apocarpum*, *Br. & Schimp.*; loosely tufted; leaves spreading from an erect base, erect when dry, lanceolate, the upper ones hair-pointed; margin recurved; nerve slender; sporangium firm, ovate; ring none; lid shortly rostrate; teeth entire or perforated, dark-red.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1134, 1345, 2226.*; (Plate 21, fig. 6); *Moug. & Nest. n. 17, 508.*

On stones, etc., either in dry or very wet situations. Common. Bearing fruit in winter.

Monoicous; forming deep-green or at length brownish lax patches. Lid rather oblique, shortly rostrate, from a convex base; peristome arising deeply within the mouth of the sporangium; teeth large, entire, or slightly pierced, spreading at the base when dry, with the tips erect.

A very variable species; the leaves vary in direction and breadth, being sometimes, in extreme cases, falcate, sometimes ovato-lanceolate and obtuse, the stems in length and mode of branching, and the sporangium in form; leaf-cells punctiform above, quadrate or rectangular at the basal disk and extreme angles.

3. *S. confertum*, *Br. & Schimp.*; leaves ovato-lanceolate, the upper ones hair-pointed; margin reflexed above; sporangium ovato-globose, thin; lid from a wide convex base sharply apiculate; ring none; teeth lanceolate, much perforated and cribose.—*Hook. & Wils. t. xlvii.*; *Moug. & Nest. n. 912.*

On trap or sandstone rocks. Edinburgh. Bearing fruit in early spring.

Monoicous; forming dense deep-green cushions or tufts. Stems slender, flaccid when moist, rigid when dry. The leaves are wider than in the last, the sporangium smaller, thinner, and subspherical, and the peristome paler and more fugacious, besides being more perforated and divided.

#### ORDER XXV. *HEDWIGIACEI*, *Br. & Schimp.*

Sporangium globose or oblong, more or less immersed; peristome none; veil conical, sometimes cucullate, smooth or hairy; leaves nerveless.

#### 77. *HEDWIGIDIUM*, *Br. & Schimp.*

Sporangium more or less exserted, veil more or less cucullate, smooth; lid conico-rostellate; branches irregularly scattered, stoloniferous; leaves nearly even; tips not diaphanous; monoicous and bisexual.

1. *H. imberbe*, *Br. & Schimp.*; leaves spreading, closely imbricated when dry, subsulcate, widely ovato-lanceolate; margin slightly revolute; sporangium almost exserted; subglobose; veil obliquely cucullate.—*Hook. & Wils. t. vi.*; *Eng. Bot. t. 2237.*; (Plate 21, fig. 7.)

On the inclined faces of rocks. Ireland and Wales. Bearing fruit late in autumn.

Forming large yellowish or brownish patches. Branches stoloniferous; stems 1–8 inches long, slightly branched; leaves

obscurely plicate, acuminate but not hair-pointed, minutely serrate above; veil conical, split more or less at the base; leaf-cells very narrow, elongated and flexuose at the basal disk, elsewhere punctiform, minutely papillose above; male flowers at first terminal.

### 78. HEDWIGIA, *Ehr.*

Sporangium immersed, subsessile, globose; ring none; peristome none; veil conical, smooth or hairy; branches dichotomous; leaves nerveless, crose, diaphanous and ciliated above, papillose.

1. *H. ciliata*.—*Hook. & Wils. t. vi.*; *Eng. Bot. t. 1179.*; (Plate 21, fig. 8); *Moug. & Nest. n. 12.*

On rocks and stones, especially those which are granitic or arenaceous, in mountainous countries. Bearing fruit in early spring.

Monoicous; forming loose, glaucous-green, hoary patches. Stem at first erect; branches more or less fastigate; leaves spreading, densely imbricated when dry, oblongo-lanceolate, with diaphanous croded or ciliated points, nerveless, decurrent below; perichæatial leaves much ciliated; sporangium globose; lid plano-convex, with or without a central papilla.

A very variable plant. Veil sometimes naked, sometimes hairy; leaves sometimes striate, wider or narrower, more or less distinctly produced, varying in direction and colour; the lid blunt or acute; male flowers lateral; leaf-cells above larger and less regular, those on the basal disk broader; leaves more or less transparent, strongly papillose.

### ORDER XXVI. *ENCALYPTEI*, Br. & Schimp.

Sporangium straight, cylindrical, even or striate, covered

by the large cylindrico-campanulate veil; peristome none, single or double.

### 79. **ENCALYPTA**, *Schreber*.

Sporangium on a long fruitstalk; veil rostrate, persistent, fringed, torn, or crenate at the base; lid rostrate from a conical base; vaginula crowned at the top with a conical mass of spongy cellular tissue, which is at first included in the young calyptra, and at length forms the ocrea.

#### *a. Peristome wanting.*

1. **E. commutata**, *Nees & Hornsch.*; monoicous; leaves ovato-lanceolate, shortly apiculate, transversely waved; nerve excurrent; sporangium subcylindrical, even; veil lacinated or crenate below; lid rostrate; peristome none.—*Hook. & Wils. t. xlv.*; *Eng. Bot. t. 1419.*; (*Moug. & Nest. n. 1108.*)

In crevices of alpine rocks on lofty mountains in Scotland. Bearing fruit in summer.

Stems an inch or more long, rooting at the base; leaves spreading from an erect base, squarrose, tapering above; veil jagged at the base but not fringed, even; leaf-cells minute, hexagonal above, large, rectangular and more hyaline below.

#### *b. Peristome single or wanting.*

2. **E. vulgaris**, *Hedw.*; monoicous; stem short, branched; leaves ligulate, apiculate or obtuse, spreading; sporangium subcylindrical, even; veil entire below; peristome fugacious or wanting.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 558.*; (Plate 22, fig. 1); *Moug. & Nest. n. 117.*

On the tops of walls, stones, etc., especially in calcareous districts. Bearing fruit in spring.

Plants more or less scattered, scarce  $\frac{1}{2}$  an inch long; leaves obtuse or apiculate; nerve vanishing below the apex, or ex-

current; sporangium thin; peristome generally wanting; veil entire at the base, papillose above; leaf-cells not so distinctly hexagonal as in the last, rectangular at the base; vaginula with a conical crown. There are a few membranous fragments at the base of the veil, but in a far less degree than the next species.

3. *E. ciliata*, *Hedw.*; monoicous; leaves oblongo-ovate or ligulate, shortly acuminate, spreading, crisped when dry; margin recurved below; nerve excurrent; sporangium cylindrical, even; ring none; veil appendiculate at the base.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 1418.*; (*Moug. & Nest. n. 609*).

On rocks in alpine districts. Bearing fruit in summer.

Slightly branched, clothed with rootlets below; veil with a fringe of triangular delicate shreds, derived from the oerca; teeth sixteen, reddish.

4. *E. rhabdocarpa*, *Schwæg.*; monoicous; leaves erecto-patent, rather twisted when dry, ovato-lanceolate, nearly plane, concave below; margin erenulate, with bipartite papillæ; sporangium narrow, ovate, striate, furrowed when dry; ring narrow.—*Hook. & Wils. t. xxxii.*; *Grev. Sc. Crypt. Fl. t. 163.*; (*Moug. & Nest. n. 1110*.)

In alpine or subalpine districts, in the crevices of rocks or on the ground.

Stem rather longer than in the last; fruitstalk red, twisted; veil rather short; sporangium very rarely without any peristome, straight and regular; leaves often apiculate; leaf-cells at the base lax, rectangular, hyaline, gradually changed upward into subhexagonal.

*c. Peristome double.*

5. *E. streptocarpa*, *Hedw.*; dioicous; stem elongated, branched; leaves erecto-patent, when dry loosely imbricated,

ligulate or linear; nerve reaching to the tip; apex subeucullate, rather blunt; sporangium subcylindrical, spirally striated; peristome double.—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 2163.*; (*Moug. & Nest. n. 506.*)

On rocks, stones, and the mortar of walls. Scotland, Yorkshire, and Derbyshire. Bearing fruit late in summer.

Stems 1–2 inches long; leaves blunt; margin minutely crenulate; nerve red; perichæatial leaves narrowly lanceolate from an oblong concave base; veil at first appendiculate; sporangium with about eight spiral furrows; ring broad; teeth of outer peristome sixteen, inner of as many cilia alternating with them; spores very minute, green.

#### ORDER XXVII. *RIPARIACEI*, Br. & Schimp.

Sporangium immersed or more or less exserted; lid conico-rostrate, spiral; peristome consisting of thirty-two teeth, connected together by anastomosing processes or of an irregularly fissured, sometimes rudimentary membrane; top of the columella dilated and connected with the peristome. *Large, handsome, aquatic Mosses.*

#### 80. *CINCLIDOTUS*, Br. & Schimp.

Sporangium ovate or oval, even, with thick walls; veil smooth, conical, eucullate; peristome simple, sometimes rudimentary, of thirty-two teeth rising from a common membranous base, connected below by anastomosing processes, and twisted round the columella.

1. *C. riparius*, Br. & Schimp.; dioicous; branches fasciculate; leaves erecto-patent, elongated, lingulate, obtuse, shortly mucronate from the excurrent nerve; fruitstalk short and thick; sporangium exserted, oblong; lid obliquely rostrate;



peristome with numerous subdivisions.—*Hook. & Wils. t. xliv.*; (*Moug. & Nest. n. 1008.*)

On stones or trees, near rivulets, or on stumps. Wales, Bristol, and south of England. Bearing fruit in spring.

The short variety alone is found in Great Britain. Stems about an inch long, dull-green, but not black; fruitstalk  $\frac{1}{4}$  in. long; cells of lid spirally arranged as in *Tortula*, to which, especially to *T. subulata*, this form bears a strong resemblance.

The stems in the normal form are 3 inches or more long, and the leaves not so acute; the cells are small, irregularly quadrato-hexagonal, with a few longer cells at the base; the margin reflexed below, and slightly thickened above; sometimes acrocarpous, sometimes cladocarpous.

2. *C. fontinaloides*, *P. Beauv.*; fasciculato-ramose; leaves elongato-lanceolate, acute, keeled; nerve excurrent; margin thickened; perichætical leaves submembranous; sporangium immersed.—*Hook. & Wils. t. xi.*; *Eng. Bot. t. 557.*; (Plate 22, fig. 2); *Moug. & Nest. n. 510.*

On stones, in rivulets, or on the border of lakes, especially in calcareous districts. Bearing fruit in early spring.

Dioicous; forming large, loose, olive-green tufts several inches long, floating in the water, or erect in drier localities. Fruitstalk very short; sporangia cladocarpous, oval or oblong; lid conico-rostrate; peristome red, fugacious; spores rather large, green. Above the short vaginula, I find a thin, irregular, jagged ocrea.

#### ORDER XXVIII. *TRICHOSTOMEI*, Br. & Schimp.

Sporangium erect or pendulous; veil cucullate, subulate; peristome of thirty-two filiform teeth, distinct or united at the base, which is often tubular, frequently approximating in pairs and sometimes spirally twisted.

81. **TORTULA**, *Schreb.*

Sporangium erect, rarely cernuous; veil cucullate, with a long beak; fissure spiral; peristome single, of thirty-two filiform teeth, composed of two series of cells, twisted, united by a basal membrane of greater or less breadth.

1. *Perennial.*

a. *Basal membrane forming an elongated tube* (Syntrichia).

\* *Inflorescence doubtful.*

1. **T. papillosa**, *Wils.*; cæspitose, rather short, sparingly branched; leaves spreading, erect when dry, obovate, subacute, very concave, shortly hair-pointed, papillose at the back and on the thick, spongy, gemmiparous nerve; margin plane, strongly involute when dry; leaf-cells lax.—*Hook. & Wils. t. xliv.*

On trees. Wales, Yorkshire, and south of England. Not yet found in fruit. I have seen no specimens.

\*\* *Synoicous.*

2. **T. Mulleri**, *Wils.*; densely cæspitose; stem elongated, dichotomous; leaves erecto-patent, imbricated when dry, oblong, obtuse, hair-pointed; margin reflexed; nerve excurrent; sporangium cylindrical, curved on a long fruitstalk.—*Hook. & Wils. t. xliv.*

On rocks. Scotland, Mr. Drummond. Bearing fruit in early summer.

Forming olivaceous or brownish tufts, 1–2 inches long. Leaves firm, shrinking but little in drying.

\*\*\* *Dioicous.*

3. **T. ruralis**, *Schwæg.*; tufted; leaves squarrose, recurved, oblong, from a sheathing base, very obtuse, with rough hair-

points, keeled ; margin recurved ; sporangium elongated, somewhat incurved ; lid as long as the sporangium.—*Hook. & Wils. t. xii.* ; *Eng. Bot. t. 2070.* ; (Plate 22, fig. 4) ; *Moug. & Nest. n. 26.*

On walls, thatched roofs, banks, etc. Very common. Bearing fruit in early spring.

Forming large, loose, green cushions or patches, hoary with the hair-points of the leaves, 1–3 inches high. Leaf-cells small and very compact above, very loose, diaphanous and rectangular below ; ring of a double row of cells ; the tube is tessellated, composed of rectangular cells, forming regular courses, and the free threads which consist of two distinct parts, a narrow, darker, and a broader light portion are immediately derived from the cells, the darker part arising from the walls, the lighter from the contained sac.

4. **T. intermedia**, *Brid.* ; stems densely tufted ; subpulvinate ; leaves erecto-patent, upper ones somewhat incurved, very obtuse, with a very rough hair-point ; sporangium shorter on a shorter fruitstalk.—*Syntrichia intermedia*, *Brid. Bryol. Eur.*

On rocks. Near Conway ; Malham, Yorkshire, W. Wilson. Bearing fruit in spring.

Leaves slightly twisted. Distinguished from *Tortula ruralis* by its extremely obtuse, flat, erect leaves, and other points.

5. **T. latifolia**, *Bruch* ; upper leaves rosulate, spatulato-lingulate ; nerve ending at the obtuse emarginate apex or slightly excurrent ; margin nearly plane ; sporangium long, subcylindrical ; lid shortly rostrate ; ring simple.—*Hook. & Wils. t. xliii.* ; (*Moug. & Nest. n. 921.*)

On trees, etc. From Scotland to Essex. Bearing fruit, but very rarely in summer.

Forming loose, dark, lurid-green patches. Leaves very

blunt, emarginate, with a small apiculus, slightly recurved; tube of peristome rather short; ring small; leaf-cells above minute, punctiform, those of the basal disk and the extreme angles rectangular and hyaline, resembling those of *Encalypta*.

\*\*\*\* *Monoicous*.

6. *T. lævipila*, *Schwæg.*; leaves oblong or spathulate, rounded and emarginate above, with a long white, nearly even hair-point, arising from the excurrent nerve; sporangium subcylindrical, curved; peristome much twisted; tube moderately long.—*Hook. & Wils. t. xliii.*

On trees and sometimes on stones. Bearing fruit in early summer.

Forming compact green tufts. Leaves broader above, less squarrose than in *T. ruralis*; margin plane above, recurved below, hair-point nearly even.

7. *T. subulata*, *Hedw.*; loosely tufted; stem short; leaves obovato- or spathulato-oblong, mucronate, surrounded by a more or less conspicuous yellowish border; margin plane; sporangium elongated, subcylindrical, slightly curved; tube of the peristome very long; ring of two rows of cells, subsistent.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 1101.*; *Moug. & Nest. n. 126*).

On banks and about the roots of trees, especially in a sandy soil. Bearing fruit in early summer.

Forming bright-green patches. Leaves broader upwards; lid rather short; leaf-cells above larger than in some species, subhexangular, rectangular at the base; border sometimes toothed, consisting of from one to four rows of narrow, slightly sinuous cells, without chlorophyll. There is a variety with a very indistinct mucro, which has been found in Lancashire and Hampshire.

It generally affects a calcareous soil.

b. *Nerve of leaves round; teeth much twisted, springing from a membrane much shorter in general than themselves* (Barbula).

\* *Leaves widely lanceolate or more or less spatulate.*

8. **T. canescens**, *Bruch*; leaves more or less obovate, hair-pointed; margin reflexed; sporangium elliptic, equal, thin-walled; lid conical, blunt; ring rather broad; basal membrane tubular, rather long.—*Hook. & Wils. t. xliii.*

On trees, soil, etc., principally in argillaceous districts. Sussex, Mr. Jenner. Bearing fruit in spring.

Distinguished from *T. muralis* by the shorter, wider, softer leaves, their less recurved margin and the elongated basal tube, which is one-third or half as long as the teeth, presenting in fact the characters of *Syntrichia*.

9. **T. marginata**, *Wils.*; monoicous; leaves oblongo-lanceolate, with a thickened yellowish margin; nerve slightly excurrent; sporangium oblong; lid shortly rostrate, basal membrane narrow.—*Hook. & Wils. t. xliii.*

On walls and on the ground. North and south of England. Rare. Bearing fruit in early summer.

Leaves narrower than in *T. muralis*, which it much resembles; margin distinct, of a double row of cells, not at all reflexed; ring broader. The British specimens in general have narrower leaves. Schimper's character, "broadly oblongo-lanceolate," will not apply to them.

10. **T. muralis**, *Hedw.*; monoicous; stem short; leaves oblong, subspathulate; margin strongly recurved; sporangium oblong, erect; lid shortly rostrate, basal membrane narrow; ring narrow; subsistent.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 2033.*; (Plate 22, fig. 3); *Moug. & Nest. n. 127, 1112.*

On walls and stones. Very common. Bearing fruit in spring.

Forming little glaucous tufts. Leaves obtuse, with a more or less excurrent nerve; margin apparently thickened, but really closely recurved; hair-points even.

Varying with longer stems, larger, longer, or narrow leaves, bluntish points, etc. Occasionally the sporangium is slightly curved. Leaf-cells minute above, filled with chlorophyll, in the lower half gradually longer and hyaline.

11. *T. oblongifolia*, *Hook. & Wils.*; monoicous; gregarious; stem short; leaves spreading, subflaccid, opaque, erect when dry, elliptic, oblong, rather obtuse, with a very small mucro; nerve slightly excurrent; margin plane; sporangium elongated, narrow, subcylindrical; lid conico-rostellate; basal membrane broad.—*Hook. & Wils. t. xliii.*

Moist banks, near Dublin, Mr. Drummond. Bearing fruit very early in spring.

Of this I have seen no specimens, nor does it seem to be taken up by Schimper. It is known from the last by the plane margin of the leaves and narrow sporangia, and from *T. cuneifolia* by the opaque oblong leaves.

12. *T. cuneifolia*, *Smith*; monoicous; gregarious; stem short, simple; upper leaves rosulate obovate or spatulate, shortly acuminate; nerve reaching only to the apex, or excurrent and forming a hair-point; sporangium oblong; lid rather short and obtuse; ring narrow; basal membrane rather broad.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 1510.*; (*Moug. & Nest. n. 919.*)

On banks, especially near the sea. Bearing fruit in spring.

Densely gregarious, soft and flaccid. Lower leaves broadly ovate, acuminate, upper forming a rose-like expansion; peristome much twisted; leaf-cells rather large, hexagonal above,

with very little chlorophyll, below broadly and nearly exactly rectangular.

I omit *T. stellata*, Smith (*Bryum stellatum*, Dieks.), as it has never been found on the Continent, and is in all probability a tropical Moss, admitted by some mistake into the list of British Mosses.

\*\* *Leaves narrow, lanceolate.*

13. *T. squarrosa*, De Not.; dioicous; loosely tufted; leaves recurvo-squarrose, from a broad sheathing base, lanceolate, slightly undulated, serrulate at the apex; margin plane; nerve subexcurrent; sporangium erect, oblong, slightly curved; lid concave, subulate; ring simple.—*Hook. & Wils. t. xliii.*

On dry hills. Dublin and Sussex. Bearing fruit on the Continent in May and June.

Forming yellow-green loose tufts. Stem brittle, erect or procumbent, an inch or more long; leaves crisped when dry; leaf-cells above minute, very lax below; teeth twisted.

14. *T. tortuosa*, Hedw.; dioicous; pulvinate; stem elongated, dichotomous; leaves crowded, spreading, eurred when dry, linear-lanceolate from an ovate translucent base; margin plane, undulated; nerve excurrent; sporangium erect, ovato-oblong, sometimes eurred; teeth much twisted.—*Hook. & Wils. t. xii.; Eng. Bot. t. 1708.; (Moug. & Nest. n. 314.)*

On rocks, especially such as are calcareous, as at Matlock. Bearing fruit in summer.

Forming yellow-green tufts. Stems  $\frac{1}{2}$ –3 inches long; leaves very long; leaf-cells minute above, filled with chlorophyll, translucent and rectangular, but rather narrow below; basal membrane very narrow.

15. *T. convoluta*, Swartz; dioicous; densely tufted; leaves

narrow, oblongo-lanceolate from a slightly expanded base; margin reflexed below; perichaetial leaves convolute; sporangium slightly ovato-oblong, curved; lid subulate; ring distinct.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 2382.*; (*Moug. & Nest. n. 716.*)

On walls and banks, especially in calcareous districts. Bearing fruit in summer.

Forming large, short, yellow-green patches. Leaves crisp when dry; nerve ceasing at or near the tip; more translucent than the disk; fruitstalks of a beautiful pale-yellow, slender; teeth much twisted; basal membrane narrow; leaf-cells above minute, filled with chlorophyll, gradually increasing in size to the basal disk, those at the wings large and rectangular.

16. *T. revoluta*, *Hook. & Tayl.*; dioicous, subpulvinate; leaves erecto-patent, rather obtuse, lanceolate, imbricated and somewhat twisted when dry; nerve thickened above and slightly excurrent; margin strongly revolute; perichaetial leaves loosely sheathing; veil large; sporangium oval-oblong; lid oblique; ring simple; basal membrane narrow.—*Hook. & Wils. t. xii.*; (*Moug. & Nest. n. 218.*)

On walls, especially in limestone districts. Bearing fruit in April.

Forming pale, dense, yellowish-green patches. Stem scarcely more than  $\frac{1}{2}$  an inch high; fruitstalk reddish; sporangium rather small. Scarcely ever growing on the ground. Distinguished at once by the differently-coloured fruitstalk, simply sheathing perichaetial leaves and their revolute margin. Leaf-cells larger than in the last, nerve much thicker.

17. *T. Hornschuchiana*, *Wils.*; dioicous; loosely tufted; leaves spreading, somewhat recurved, incurved or spirally imbricated when dry, lanceolate, keeled, acute; margin revolute; nerve excurrent, rather slender; perichaetial leaves loosely



sheathing; sporangium erect, oblong; ring narrow.—*Hook. & Wils. t. xliii.*; (*Moug. & Nest. n. 820*); *Eng. Bot. t. 2383*.

On walls, rocks, and the naked ground. Bearing fruit late in the spring.

Forming patches of a brownish-green. Stems and leaves not densely crowded; nerve much thinner than in the last. I do not find the leaf-cells larger, as stated by Mr. Wilson, but the contrary.

There can be little doubt that the 'English Botany' figure belongs to this rather than the last.

The plant gathered by Mr. Thwaites near Bristol, without fruit, and referred to *T. gracilis*, is, to say the least, doubtful; and as it is the only real authority for admitting the species into our Flora, it is better, I think, at present to omit it.

18. *T. vinealis*, *Wils.*; dioicous; cæspitose; leaves spreading, recurved, erect, and loosely incumbent when dry, ovato-lanceolate; margin slightly recurved, nearly plane above; sporangium ovato-oblong, erect; ring distinct; lid shortly rostrate; peristome once twisted; membrane evident.—*Hook. & Wils. t. xlii.*; *Eng. Bot. t. 2316*.

On walls, etc. North and south of England. Bearing fruit in spring.

Forming yellowish tufts. Differs from *T. fallax* in the denser tufts, shorter, less recurved leaves, shorter, thicker sporangia, shorter fruitstalk, lid, and peristome, simple ring, and smaller leaf-cells. It varies considerably in length, and if the 'English Botany' figure is rightly quoted it represents a form with longer stems.

19. *T. fallax*, *Swartz*; dioicous, cæspitose; leaves squarrose, recurved, twisted when dry, linear-lanceolate, keeled, acuminate; margin recurved; nerve subexcurrent; perichæatial leaves sheathing, spreading; sporangium subcylindrical;

ring none; lid rostrate.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 2179.*; (*Moug. & Nest. n. 715.*)

On the ground, especially in calcareous or clay districts, common. Bearing fruit in autumn and winter.

Forming soft rusty-green tufts. A very variable species, distinguished from *T. unguiculata*, which is still more variable, by its peculiar tint, recurvo-squarrose, hygroscopic, acuminate leaves, and narrower firmer sporangium. The upper leaf-cells moreover are more distinct and punctiform, while the lower are not so lax or strictly rectangular.

20. *T. recurvifolia*, *Schimp.*; loosely tufted; leaves spreading, curved strongly backwards, loosely incumbent when dry, lanceolate from an oblong base, acutely keeled, papillose on either side; nerve vanishing at the tip; margin reflexed below; sporangium erect, elongated; lid subulate; ring none.—*T. fallax*, var.  $\delta$ , *Hook. & Wils. Bryol. Brit. p. 124.*

On rocks and calcareous walls. Bearing fruit, but rarely, in autumn.

Forming rufous tufts. Leaves trifarious, not twisted when dry as in the last.

21. *T. unguiculata*, *Hook. & Tayl.*; cæspitose, soft; leaves more or less spreading, ovato- or oblongo-lanceolate, mucronate from the excurrent nerve; margin recurved; sporangium subcylindrical, erect; lid subulate.—*Hook. & Wils. t. xii.*; *Eng. Bot. t. 1299, 1663, 2391, 2393, 2494, 2495.*; (*Moug. & Nest. n. 27.*)

On the ground, especially in a clayey soil. Very common. Bearing fruit in winter.

Forming wide green tufts. Ring none; basal membrane very narrow. Extremely variable in height, branching, width and length of leaves, but distinguished from *T. fallax* in every stage as above.

*c. Leaves rigid; nerve clothed with jointed threads (Tortula).*

22. **T. aloides**, *Wils.*; dioicous; stem short; leaves spreading, linear-lanceolate, acute, strongly nerved; margin incurved; sporangium cylindrical, oblique; fruitstalk curved above; ring fragmentary; lid rostrate from a conical base; teeth in pairs, scarcely twisted.—*Hook. & Wils. t. xlii.*; *Eng. Bot. t. 180, 2759.*; (*Moug. & Nest. n. 717.*)

On clay banks. Bearing fruit in winter.

Extremely short. Leaves more rigid with a stronger nerve; margin strongly incurved; basal membrane rather broad; teeth divaricated when dry, pallid; spores larger than in the two following species; nerve, which is prominent below, though not above, and part of the disk, concealed by a mass of jointed threads analogous to the plates in *Polytrichum*.

23. **T. ambigua**, *Wils.*; dioicous; stem short; leaves spreading, ligulato-lanceolate from an ovate base; rather obtuse, concave, incurved, and cucullate above; margin incurved; sporangium cylindrical, erect; teeth slightly twisted.—*Hook. & Wils. t. xlii.*

On walls and banks. Common on the caps of the oolitic walls in Northamptonshire. Bearing fruit in winter.

Stem very short; leaves stellate; teeth incurved when dry, red, filiform at the base. Distinguished from the last by its erect sporangium, and from the following by its cylindrical sporangium, besides other points.

24. **T. rigida**, *Wils.*; dioicous; stems short; leaves spreading, oblong, obtuse; margin membranaceous, inflexed; sporangium elliptico-oblong, straight, erect; ring distinct; lid obliquely rostrate; peristome rather long, much contorted.—*Hook. & Wils. t. xxxii.*; *Grev. Sc. Crypt. Fl. t. 331.*; (*Moug. & Nest. n. 613.*)

On walls, especially in calcareous districts, chalk pits, etc. Bearing fruit in winter.

Very like the last two, but distinct in the form of the sporangium, which is half covered by the veil, which in those species is much shorter.

## 82. TRICHOSTOMUM, *Br. & Schimp.*

Sporangium erect or more rarely curved; veil cucullate, smooth; peristome single, of thirty-two more or less perfect, straight teeth, disposed in pairs, composed of a single series of elongated cells, sometimes so united or perforated as to look like sixteen, connected by a narrow basal membrane; leaf-cells punctiform above, minutely papillose, rectangular and hyaline below. *Perennial, terrestrial Mosses, with the habit of Tortula.*

1. *T. rigidulum*, *Smith*; tufted; leaves spreading and recurved, elongato-lanceolate, keeled; margin recurved; nerve subexcurrent; sporangium subcylindrical; ring narrow; teeth in pairs or free, sometimes connected by transverse bars.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 2178.*; (*Moug. & Nest. n. 612.*)

On moist rocks or upon dry, exposed, calcareous walls. Bearing fruit in autumn and winter.

Loosely tufted. Stem straight, about an inch high, of a brownish or dull green; leaf-cells distinct, punctiform; lid obliquely rostrate. When growing on dry walls it is shorter, the sporangium more elliptic, and the lid longer.

2. *T. tophaceum*, *Brid.*; stem branched, elongated; leaves spreading from an erect base, lanceolate, obtuse; nerve ceasing below the tip, keeled, concave; sporangium oblong, subcylindrical; ring none; lid obliquely rostrate; teeth irregular, in pairs.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 1598, 1707, 2295.*

On calcareous or gritty, moist rocks. Bearing fruit in winter and early spring.

Stems of a dull deep-green; leaves rather twisted when dry; teeth as in the last, very variable, sometimes reduced to sixteen, in both springing from a narrow basal membrane; nerve always shorter.

3. *T. mutabile*, *Bruch*; leaves spreading, erisped when dry, lanceolate, acute; margin plane, slightly undulated; nerve excurrent, forming a short point; sporangium ovate; lid rostrate; teeth very short.—*Hook. & Wils. t. xli.*; *Eng. Bot. t. 2735*.

In crevices of rocks and on the ground in calcareous districts, mostly near the sea. Wales, Ireland, and Sussex. Bearing fruit in summer.

Stems short, bright-green; leaf-cells dense and punctiform above, then exactly quadrate, rectangular and hyaline at the base; teeth unequal from a narrow membrane, very fugacious.

4. *T. crispulum*, *Bruch*; leaves spreading, erisped when dry, lanceolate or linear-lanceolate, concave and almost cucullate at the tip; nerve excurrent, forming a short point; sporangium oval; lid obliquely rostrate; ring none; teeth in unequal pairs.—*Hook. & Wils. t. xli.*; *Eng. Bot. t. 2734*.

On limestone rocks and banks near the sea. Bearing fruit in summer.

Forming dense, flat, yellow patches. Leaf-cells very minute and crowded above, larger in the narrow-leaved variety (*Moug. & Nest. n. 915*); teeth of peristome much longer than in the last species.

5. *T. convolutum*, *Brid.*; pulvinato-caespitose; leaves spreading, twisted when dry, oval-oblong, apiculate; nerve strong, thickened above and slightly excurrent; margin revolute;

sporangium ovate ; ring none ; lid obliquely rostellate ; teeth unequal.—*Hook. & Wils. t. xx.* ; *Eng. Bot. t. 2015.* ; (Plate 22, fig. 8) ; *Moug. & Nest. n. 914.*

Near the sea, on walls, banks, etc. Bearing fruit in spring.

Monoicous ; forming dull-green tufts. Leaf-cells dense above, lax below, more like those of *Trichostomum* than *Desmatodon*. Sometimes the peristome is very imperfect. It is *Desmatodon nervosus* of the 'Bryologia Britannica.'

### 83. LEPTOTRICHUM, *Hampe.*

Sporangium erect ; peristome single, of thirty-two teeth arranged in pairs, sometimes reduced to sixteen ; leaves glossy ; narrow, elongated, translucent, not papillose.

1. *L. tortile*, *Müll.* ; stem short ; leaves spreading or secund, curved, lanceolato-subulate, serrated at the tip ; margin reflexed ; nerve excurrent ; sporangium cylindrical ; lid short ; ring narrow ; peristome variable.—*Hook. & Wils. t. xli.* ; *Eng. Bot. t. 2380.* ; (*Moug. & Nest. n. 1012.*)

On sandy banks, in quarries, etc. Ireland, Yorkshire, and Sussex. Bearing fruit late in autumn.

Dioicous ; gregarious or loosely tufted. Lid a quarter as long as sporangium ; teeth of peristome red, varying in length and in pairing ; leaf-cells elongated, not at all resembling those of *Tortula*.

2. *L. flexicaule*, *Müll.* ; stems elongated, slender, much branched, densely tufted ; leaves spreading or secund, lanceolato-subulate ; nerve broad, excurrent ; sporangium small, ovato-oblong ; ring simple ; lid shortly rostellate ; teeth unequal, rather long.—*Hook. & Wils. t. xlii.* ; (*Moug. & Nest. n. 213.*)

On calcareous rocks, Scotland and Derbyshire. Bearing fruit on the Continent in summer.

Dioicous; forming yellowish-green tufts 1–3 inches or more high. Stems flexuose, covered with rootlets; nerve of leaves occupying almost the whole disk; leaf-cells as in the last; peristome very fugacious; teeth unequal, sometimes anastomosing below.

A much larger plant than the last, with taller stems, and much longer, more setaceous leaves; margin plane.

3. *L. homomallum*, *Müll.*; loosely tufted; stems short; leaves spreading or secund, subulato-setaceous, from an ovate base; nerve broad, excurrent; sporangium ovato-oblong; ring narrow; lid short, conical; teeth simple or united in pairs; basal membrane very short.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 1899, 1900.*; (Plate 22, fig. 5); *Moug. & Nest. n. 19.*

On sandy soil, etc., especially in mountainous districts. Bearing fruit in autumn.

Dioicous; forming lax, green, glossy patches. Leaves mostly secund; nerve excurrent and predominant, but ill defined; teeth sometimes reduced to sixteen; leaf-cells as in the last two species.

4. *L. subulatum*, *Müll.*; stems short; leaves spreading or secund, subulate from an ovate base, widely recurved; sporangium oval; ring none; lid conico-rostellate; basal membrane very narrow; antheridia naked, axillary.—*Hook. & Wils. t. xlii.*

On banks in Cornwall. Mr. Tozer. Bearing fruit in spring.

Monoicous; yellow-green. Stems 3–4 lines high; lid obliquely rostrate. Differs from the last in the inflorescence, deficient ring, and more slender teeth.

5. *L. glaucescens*, *Hampe*; cæspitose; leaves linear-lanceolate, more or less sprinkled with a glaucous leprous substance, toothed above; nerve subexcurrent; margin plane;

sporangium oval-oblong; lid conico-rostellate; basal membrane very narrow.—*Hook. & Wils. t. xxxiii.*; *Eng. Bot. t. 2381.*; *Grev. Sc. Crypt. Fl. t. 127.*; (*Moug. & Nest. n. 913.*)

Highlands of Scotland. Rare. Bearing fruit in summer.

Monoicous; densely cæspitose. Leaves in themselves green, but glaucous from excessively minute threads mixed with a granular substance similar to what occurs in *Bartramia pulverulenta*. The leaf-cells are broader and more rectangular than in the other species, but very unlike those of *Tortula*. The nature of the glaucous matter is unknown, but it does not appear to be any condition of a Mould or Lichen, but to be thrown off from the surface of the plant.

#### 84. DIDYMODON, *Br. & Schimp.*

Sporangium erect, subcylindrical, with a very short tapering base; veil cucullate, covering at least half the sporangium; peristome rather short; teeth sixteen, linear-lanceolate, of a double row of cells, tender and fugacious, entire or perforated; leaf-cells narrow.

1. *D. rubellus*, *Br. & Schimp.*; tufted; leaves spreading and recurved, crisped when dry, lanceolate from an amplexicaul base; margin recurved; nerve reaching almost to the tip; sporangium cylindrical; lid shortly and obliquely rostrate; teeth entire or cloven.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1438.*

On shady walls, on the ground, etc. Bearing fruit from October to February.

Monoicous and synoicous; forming dull-green patches, which are red below. Ring simple; leaf-cells above minute, filled with chlorophyll, below rectangular and hyaline, much resembling those of *Tortula*; teeth of peristome pale, lanceolate, entire, with a medial line and projecting at the articula-



tions, or variously cleft and perforated ; often differing from each other in the same peristome.

2. *D. luridus*, *Hornsch.* ; dioicous ; leaves ovato-lanceolate, erecto-patent, keeled, straight and erect when dry ; margin reflexed ; nerve strong, ending at the apex ; sporangium oblong or cylindrical ; lid conico-aeuminate ; ring narrow, persistent, teeth irregular.—*Hook. & Wils. t. xli.* ; (*Moug. & Nest. n. 818.*)

On moist ground and stones. Ireland, Yorkshire, Kent, and Sussex. Bearing fruit from December to April.

Dioicous. Stems short, slightly tufted ; leaf-cells above minute, crowded, those of the disk below the middle quadrate and translucent, the very lowest only slightly elongated and rectangular ; teeth of peristome very irregular and tender, often rudimentary, simple or bipartite, inserted below the orifice, with scarcely any basal membrane.

3. *D. cylindricus*, *Br. & Schimp.* ; dioicous ; tufted ; leaves long, spreading, linear, somewhat undulated, crisped when dry, slightly toothed at the apex ; wings opaque ; sporangium cylindrical ; lid subulate ; ring narrow ; teeth fugacious, variable.—*Hook. & Wils. t. xxxiii.* ; (*Moug. & Nest. n. 1006.*)

On stones and rocks, seldom if ever in limestone districts. Bearing fruit in October.

Forming loose, short, soft, yellow-green tufts. Leaves brittle above ; margin granulated ; leaf-cells dense and minute above, very slowly increasing to the base, those at the basal wings hyaline and larger. This species has much the appearance of *Tortula tortuosa*, but the leaf-cells are different, without adverting to the peristome.

4. *D. flexifolius*, *Hook. & Tayl.* ; dioicous ; erecto-patent ; leaves flexuous, crisped when dry, oblong or lingulate, apiculate, coarsely toothed ; margin plane above, reflexed below ;

nerve vanishing below the apex ; sporangium cylindrical ; lid rostellate ; ring narrow ; teeth very short.—*Hook. & Wils. t. xx. ; Eng. Bot. t. 2493. ;* (Plate 22, fig. 6.)

On stones, straw, roofs, etc. Bearing fruit in early spring.

Forming bright-green soft tufts. Leaves broader than in the foregoing species ; leaf-cells subquadrate, slightly elongated towards the base ; stems often bearing little branchlets, which are easily detached, and may be mistaken when fallen for some *Phascum* ; leaves sometimes gemmiparous.

5. *D. recurvifolius*, *Tayl.* ; stems elongated, loosely cæspitose ; leaves squarrose, crisped and undulated when dry, elliptico-oblong or ligulate, pale, margined, serrulate ; nerve sub-excurrent.—*Hook. & Wils. t. xli.*

Near Killarney.

A doubtful species, as it has not hitherto been found in fruit, bearing some resemblance to *Tortula squarrosa*.

### 85. *DISTICHIUM*, *Br. & Schimp.*

Sporangium oval-oblong or subcylindrical, with a short tapering base ; lid cucullate, with a slender beak ; peristome of sixteen teeth inserted below the mouth of the sporangium, not confluent at the base, equidistant, transversely barred, marked with a medial line, entire or perforated, occasionally cleft ; leaves more or less distichous ; leaf-cells minute above, large and diaphanous below.

1. *D. capillaceum*, *Br. & Schimp.* ; densely tufted ; leaves spreading, subulate, from a semiamplexicaul base ; sporangium erect, subcylindrical ; teeth narrow, distantly articulate, irregularly cloven.—*Hook. & Wils. t. xx. ; Eng. Bot. t. 1152. ;* (Plate 22, fig. 7) ; *Moug. & Nest. n. 211.*

In crevices of mountain rocks. Bearing fruit in summer.

Monoicous ; forming large dense-green patches. Lid short ;

leaf-cells narrow, elongated below. I do not find them roundish.

2. *D. inclinatum*, *Br. & Schimp.*; subcæspitose; leaves crowded, subulate above and toothed; sporangium cernuous, oval, teeth lanceolate, nearly entire or perforated with numerous articulations.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 1824.*

Mountain rocks and sands near the coast. Rare. Bearing fruit in summer.

Monoicous; forming soft, dull olive-green patches. Ring broader; spores larger; leaves more crowded than in the last, shorter and narrower above; teeth of the peristome wider.

### 86. DESMATODON, *Brid.*

Sporangium erect or cernuous; veil rather long, cucullate; peristome single, of sixteen subulate teeth, united at the base by a common membrane, often split, the divisions free or connected by trabeculæ; leaves broad; leaf-cells above hexagonal, elongated, and very large below.

1. *D. latifolius*, *Brid.*; leaves erecto-patent, oblongo-lanceolate, acuminate, mucronate; margin revolute; nerve excurrent; sporangium subcylindrical, oblong; lid obliquely rostrate; ring small; veil twice as long as the sporangium.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 2492.*; (*Moug. & Nest. n. 1007.*)

On the tops of lofty mountains. Bearing fruit in summer.

A doubtful native. Confounded frequently with *Anacalypta lanceolata*, from which it may be known by the more tapering teeth, which are deeply cloven and mostly free.

### ORDER XXIX. POTTIEI, *Br. & Schimp.*

Sporangium pedunculate, straight; peristome none or of sixteen teeth; veil cucullate; leaves composed above of rather large hexagonal cells, and large rectangular cells at the base.

87. ANACALYPTA, *Röhling*.

Sporangium oval; veil cucullate; peristome single or of sixteen teeth, united at the base by a common membrane, entire or imperfectly divided down the centre, sometimes fragmentary; leaf-cells rather wide, quadrate or rectangular, enlarged below.

1. *A. Starkeana*, *Nees & Hornsch.*; gregarious, annual; leaves ovato- or oblongo-lanceolate, mucronate from the slightly excurrent nerve; margin recurved; lid conical, obtuse; teeth obtuse, without a medial line, more or less perforated.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1490.*; (*Moug. & Nest. n. 712.*)

On the ground, in pasture or ploughed fields. Bearing fruit in winter.

Monoicous; scattered or cæspitose. Sporangium minute; ring narrow, persistent; peristome extremely variable; teeth lanceolate, obtuse or truncate, bifid, entire or cribose.

2. *A. cæspitosa*, *Bruch*; stems very short, simple or branched; leaves spreading, ovate or oblongo-lanceolate, shortly mucronate from the excurrent nerve; lid rostrate; ring simple; teeth more or less perfect, perforated or split.—*Hook. & Wils. t. xli.*; (*Moug. & Nest. n. 909.*)

On chalk hills. Sussex, Mr. Mitten. Bearing fruit in spring.

Monoicous.

Distinct from the last in the sheathing perichætium, the long beak, the more perfect peristome, and broader ring.

3. *A. lanceolata*, *Röhl.*; cæspitose; stems elongated, branched; leaves spreading, obovate or oblong, with a long mucro from the excurrent nerve; margin reflexed; sporangium elliptic; ring broad; teeth linear-lanceolate, with a

medial line, entire or pierced.—*Hook. & Wils. t. xiv.*; *Eng. Bot. t. 1408.*; (Plate 23, fig. 1); *Moug. & Nest. n. 310.*

On walls, etc., in calcareous districts. Bearing fruit in March.

Forming patches of various sizes. Stems from 1 line to  $\frac{1}{2}$  an inch long; teeth very variable.

4. *A. latifolia*, *Nees & Hornsch.*; gregarious, bulbiform, very short; leaves imbricated, widely obovate or roundish, apiculate or obtuse, glossy, concave; nerve ceasing below the tip; sporangium oval or oblongo-elliptic; lid shortly rostrate; teeth lanceolate, entire or cloven, united at the base by a narrow membrane.—*Hook. & Wils. t. xxxiii.*; *Eng. Bot. t. 2535.*; *Grev. Sc. Crypt. Fl. t. 149.*; (*Moug. & Nest. n. 1105.*)

Scotland. Rare. Bearing fruit in spring.

Monoicous. Leaves imbricated so as to form a little hop-like bulb, whitish, shining; leaf-cells large.

### 88. POTTIA, *Ehrh.*

Sporangium exserted or immersed; veil cucullate; peristome none; apex of columella falling away with the lid; leaf-cells quadrate or rectangular, enlarged below.

1. *P. cavifolia*, *Ehrh.*; stem very short; leaves spreading, ovate or oblongo-lanceolate, mucronate or piliferous from the excurrent nerve; fruitstalk short; sporangium oval; lid obliquely rostrate, shorter than the sporangium.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 1889.*; (*Moug. & Nest. n. 308.*)

On clay walls, the naked ground, etc. Common. Bearing fruit in winter.

Gregarious or caespitose, monoicous. Leaves concave; nerve bearing three or four membranous appendages on the upper side, which at first consist of a swollen follicle on either side of the nerve. (Plate 23, fig. 2, e.)

2. *P. minutula*, *Br. & Schimp.*; very short, gregarious, annual; leaves spreading, ovato- and oblongo-lanceolate, hair-pointed from the excurrent nerve; margin recurved; sporangium small, truncate, ovate; lid large, conical.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 2676, f. 1.*; (*Moug. & Nest. n. 709.*)

In fallow fields, principally on a clay soil.

Monoicous; brownish-green, varying with the sporangium slightly contracted at the mouth, in the breadth of leaves, length of the hair-point, etc.

3. *P. truncata*, *Br. & Schimp.*; leaves more or less spreading, ovato-oblong and subspathulate, shortly acuminate, mucronate from the excurrent nerve; margin reflexed; sporangium truncato-obovate or oblong, wide-mouthed; lid obliquely rostrate, convex at the base.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 1975, 1976.*; (*Moug. & Nest. n. 114, 809.*)

On mud walls, in fallow fields, etc. Bearing fruit in early spring.

Monoicous; annual or perennial. Stem short or elongated; nerve more or less excurrent; lid falling off with a portion of the columella. The oblique rostrate beak distinguishes the smaller forms from the preceding species. The smaller form is represented in *Eng. Bot.* at *t. 2676, f. 2*, by way of comparison.

4. *P. Wilsoni*, *Br. & Schimp.*; somewhat tufted, simple; leaves crowded, erecto-patent, oblong, spathulate, rounded at the apex, hair-pointed from the excurrent nerve; lid obliquely rostrate; veil rough at the tip; sporangium elliptico-oblong; spores small.—*Hook. & Wils. t. xli.*; *Eng. Bot. t. 2710.*

On sandy ground. Bearing fruit in February.

Leaves octofarious, densely chlorophyllous in the upper part, in which character it departs from the generic character, though the cells when cleared out are not very small; male

flowers not gemmiform as in the last, but consisting of naked axillary antheridia, accompanied by paraphyses.

5. *P. crinita*, *Wils.*; densely tufted; leaves oblong and elongato-spathulate, rounded above, rigidly hair-pointed from the excurrent nerve; sporangium elliptic, scarcely contracted at the mouth, lid obliquely rostrate.—*Hook. & Wils. t. xli.*; (Plate 23, fig. 2.)

On moist banks on the seacoast. Scotland, south of England and Channel Islands. Bearing fruit in February.

Nearly allied to the last, and differing in its more densely tufted mode of growth, its more obovate and obtuse leaves, and stronger nerve. Leaf-cells larger and less filled with chlorophyll; veil even; antheridia, as in that, naked and axillary. Not yet found on the Continent.

6. *P. Heimii*, *Br. & Schimp.*; tufted; leaves spreading, elongato-lanceolate, toothed above; margin plane; nerve ceasing at or below the apex; sporangium obovate or oblong, truncate; lid obliquely rostrate, adhering to the columella.—*Hook. & Wils. t. vii.*; *E. Bot. t. 1407, 1951.*; (Plate 23, fig. 3.)

On moist banks, principally near the sea.

Polygamous; varying in size and in the leaves. Distinguished from the small variety of *P. truncata* by the stouter habit; the longer, softer leaves, which are toothed above; the nerve not excurrent; the polygamous inflorescence; the lid lifted up by the columella when the sporangium is ripe, and in its place of growth. It occurs at the Cape of Good Hope, and in several places of the Northern Hemisphere.

#### ORDER XXX. *DICRANEI*, Mont.

Sporangium even or striated; peristome single, consisting of sixteen teeth, split halfway down; veil cucullate, naked at the base or fringed.

1. *Fruitstalk arched or geniculate* (Campylopodei).89. **CAMPYLOPUS**, *Brid.*

Sporangia mostly aggregate, but with separate perichætia; fruitstalks arcuate or geniculate and deflexed; ring large; veil cucullate, fringed at the base; peristome single, of sixteen narrow-lanceolate, deeply bifid teeth; leaf-cells subquadrate or rhomboid at the base, and narrow and elongated above.

1. **C. densus**, *Br. & Schimp.*; densely tufted; stems radiculose; leaves crowded, erecto-patent, rather rigid, lanceolate, subulate; nerve broad, thin, occupying the greater portion of the leaf; leaf-cells at the base lax.—*Hook. & Wils. t. xl.*

On sandstone rocks and on turfy sandy ground. Ireland and England. Bearing fruit in winter.

Dioicous, forming yellow-green patches. Stem erect, dichotomous, radiculose, sometimes with axillary deciduous branches; fruitstalk arched from the middle; sporangium oval, furrowed when dry; lid rostrate. This species has a looser reticulation, and leaves more gradually narrowed above than in *C. torfaceus*.

2. **C. torfaceus**, *Br. & Schimp.*; cæspitose, slender, rooting at the base only; leaves loosely set, spreading, setiform, from an ovato-lanceolate base; nerve moderately broad; sporangium small; fruitstalk short.—*Hook. & Wils. t. xl.*

On peaty soil. Bearing fruit great part of the year.

Differs from the last in its longer, less crowded, setaceous leaves, with a narrower and thinner nerve and broader ring.

3. **C. setifolius**, *Wils.*; stem slender, elongated, dichotomous; leaves distant, spreading, setaceous, from a lanceolate base, serrulate.—*Hook. & Wils. t. xl.*

Rocky mountainous places. Ireland.



Of this species, which has not yet been found in fruit, I have seen no specimen, and therefore copy Mr. Wilson's character.

4. *C. flexuosus*, *Brid.* ; tufted ; stem radiculose, branched ; leaves crowded, spreading or secund, lanceolato-subulate, rather rigid, obsolete furrowed at the back ; nerve broad ; sporangium oblong, wide-mouthed ; teeth slightly spreading when dry.—*Hook. & Wils. t. xvi.* ; *Eng. Bot. t. 1491.* ; (Plate 23, fig. 4.)

On the ground and on rocks, mostly in subalpine countries. Bearing fruit in November.

Forming olive-green patches, reddish below. Leaves broader and longer, not deciduous as in *C. fragilis* ; leaf-cells small, distinct, subquadrate or elliptico-oblong above, rectangular and more lax below. Moug. & Nest. n. 123 appears to be *C. densus*, and has very different leaf-cells from this, being narrow and elongated.

5. *C. longipilus*, *Brid.* ; cæspitose ; stem elongated, rigid, dichotomous ; leaves erecto-patent, lanceolato-subulate, convolute, suddenly ending in a white bristly point ; nerve very broad.—*Hook. & Wils. t. xl.*

On wet rocks and in marshy places in mountainous districts.

Forming black-green hoary tufts. Leaf-cells oblong and narrow, enlarged at the base. Perfect fruit unknown.

6. *C. polytrichoides*, *D. Not.* ; loosely tufted ; stem stout, elongated, slightly branched, naked below, slightly radiculose ; leaves erect, broadly lanceolato-acuminate, channelled, shortly hair-pointed, and slightly toothed above ; nerve stout, broad, subexcurrent, deeply sulcate behind, sublamellate.

In dry pastures. Penzance. Fruit unknown.

Bright-green above, rufous below. Leaves much broader. The above is taken from the Syllabus of De Notaris, as I have seen no specimens.

7. *C. brevipilus*, *Br. & Schimp.*; cæspitose, elongated, dichotomous; leaves lanceolate, acuminate; margin recurved; nerve narrow.—*Hook. & Wils. t.* xl.

In woods on a sandy soil. Northumberland. Fruit unknown.

Forming yellowish tufts. Leaves much shorter than in the last, with a narrower nerve, which is not sulcate at the back.

## 90. DICRANODONTIUM, *Br. & Schimp.*

Fruitstalk arched, veil cucullate, entire at the base; sporangium without striæ; ring obscure or wanting; peristome single, of sixteen linear-lanceolate distantly trabeculate teeth, very deeply cloven into two unequal divisions; leaf-cells narrow above, rectangular at the base.

1. *D. longirostre*.—*Hook. & Wils. t.* xxxix.; (*Moug. & Nest. n.* 411.)

In mountainous woods, on rocks, wood, or turf. Near Killylarney, Dr. Taylor. Bearing fruit on the Continent in autumn.

Dioicous; forming broad yellowish silky patches; leaves erecto-patent or secund, setaceous from a lanceolate base, with a broad predominant rib.

## II. *Fruitstalk straight or slightly flexuose* (Dicranei).

### 91. CERATODON, *Brid.*

Fruitstalk long, subflexuous; sporangium widely furrowed, with a short strumous neck; veil cucullate; ring broad; peristome single, of sixteen lanceolate very deeply cloven teeth, connected below by transverse, internally prominent articulations; leaf-cells small, subpunctiform above, elongated and pellucid below.

1. *C. purpureus*, *Brid.*; cæspitose, dichotomous; leaves elongato-lanceolate, keeled; margin entire, reflexed; nerve slightly excurrent; sporangium oblong or oval, erect or subcervuous, with a short neck, furrowed when dry; lid conical; teeth united below by a basal membrane, bordered with a pale margin.—*Hook. & Wils. t. xx.*; *Eng. Bot. t. 2262, 2294, 2533.*; (Plate 23, fig. 5); *Moug. & Nest. n. 24.*

On banks, pastures, etc., common. Bearing fruit in spring.

Dioicous; forming extensive dull-green patches. Stems varying in length, sometimes very short; fruitstalk red; lid conical, acute; teeth when dry spirally incurved. Found in most parts of the world. Leaf-cells distinct, quadrate, or subrotund above, about twice as long, and rectangular at the base; nerve strong.



## 92. TRICHODON, *Schimp.*

Fruitstalk long, flexuous; veil cucullate; sporangium erect, cylindrical, without striæ; ring broad; peristome of sixteen teeth split to the base, the divisions nearly equal, nodose, incurved, or hamate when dry; leaf-cells rectangular.

1. *T. cylindricus*, *Br. & Schimp.*—*Hook. & Wils. t. xxxix.*

On sandy banks. Ireland; north of England and Essex. Bearing fruit in spring.

Forming pale yellow-green patches. Stems  $\frac{1}{4}$ – $\frac{1}{2}$  inch high; leaves delicate, flexuous, squamose, subulate, from a sheathing base; nerve excurrent, predominant; leaf-cells rectangular, narrower below; sporangium quite even when dry; lid conical.

Very different in habit from *Ceratodon purpureus*, and very properly separated by Schimper.

## 93. LEUCOBRYUM, *Hampe.*

Veil cucullate; sporangium striate, furrowed when dry,

strumous at the base; ring none; peristome single, of sixteen bifid internally trabeculate teeth; leaves formed of two or more strata of rectangular pellucid cells, communicating with each other by circular pores, with narrow greener cells imbedded amongst them; marginal cells narrow.

1. **L. glaucum**, *Hampe*; densely cæspitose, dichotomous, fragile; leaves spreading or subsecund, lanceolato-subulate from an oval-oblong base, rather obtuse, apiculate; sporangium cernuous, strumous, furrowed when dry; lid rostrate.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 2166.*; (Plate 23, fig. 6); *Moug. & Nest. n. 23.*

In turbaries, damp places in woods, etc. Bearing fruit, but rarely, in spring.

Dioicous; forming large white tufts, with the appearance of *Sphagnum*. Fruitstalks often two in the same perichæcium. The young male plants nestle in a mass of fibres produced from the upper leaves or the abortive female flowers, and are ultimately developed into a little branchlet.

#### 94. **DICRANUM**, *Hedw.*

Sporangia aggregate or single in the same perichæcium; veil cucullate; peristome single, of sixteen bifid trabeculate striated teeth; leaf-cells linear, generally very narrow, dilated and rectangular at the angles. *Handsome tall Mosses.*

1. **D. Starkii**, *Web. & Mohr.*; monoicous; dichotomous; leaves subulate from a lanceolate base, irregularly falcate; sporangium oblong or cylindrical, arcuate, gibbous, strumous at the base, striate; ring double; male flower at the base of the female.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 2227.*

On alpine rocks. Bearing fruit in summer.

Forming large green tufts. Leaves entire; leaf-cells above narrow, rather flexuous, gradually broader, and more hyaline

at the base, those at the angles subquadrate and rather inflated; lid obliquely rostrate.

2. *D. falcatum*, *Hedw.*; densely tufted; leaves strongly falcato-secund, lanceolato-subulate; fruitstalk rather short and thick; sporangium cernuous, short, obovate, strumous at the base; lid rostrate.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 1989.*

On rocks and the earth in alpine districts. Bearing fruit in autumn.

Forming dense dark-green tufts. Stem decumbent at the base, naked below; leaves strongly falcate, channelled above; tip serrulate; leaf-cells as in the last; sporangium without striæ, swollen; lid large; peristome larger than in the last.

3. *D. Blyttii*, *Br. & Schimp.*; soft, tufted; stems much branched, brittle; leaves spreading or subsecund from an erect base, lanceolato-subulate, entire; sporangium cernuous, curved, without striæ; ring narrow; teeth narrow, inflexed when dry.—*Hook. & Wils. t. xxxix.*

On alpine and subalpine rocks. Scotland and Wales. Bearing fruit in August.

Monoicous; forming dull brownish-green patches. Leaves shorter than in the two last, more delicate, not so inclined to be falcate; sporangium free from striæ, even when dry; male flower not seated beneath the female, but at the base of an innovation; ring simple.

4. *D. Scottianum*, *Turn.*; densely tufted; stem radicleose; leaves spreading and subsecund, twisted above when dry, lanceolato-subulate, concave, entire; nerve strong, prominent behind, subexcurrent; sporangium elongated, slightly curved, tapering below; peristome short, teeth cloven once or twice at the tip only.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 1391, 1977.*

On mountainous rocks. Bearing fruit in summer.

Dioicous; forming green and at length brownish tufts. Leaves glossy; leaf-cells distinct, short, subpunctiform, gradually larger downwards much as in *Ceratodon purpureus*; teeth sometimes entire; lid obliquely rostrate, long and slender.

This is followed in the 'Bryologia' by a doubtful species, not yet found in fruit, *D. circinatum*, Wils., characterized by its circinate, secund, subulato-setaceous leaves from a suddenly dilated and loosely reticulated base, serrulate at the apex, with a thick and prominent nerve. The figure of *D. longifolium*, t. xvi., is apparently from a foreign specimen.

5. *D. fuscescens*, *Smith*; stems elongated, tufted, radiculose; leaves crisped when dry, lanceolato-subulate, canaliculate, toothed above; nerve excurrent; veil large, white; sporangium cernuous, incurved, swollen, ovate, furrowed when dry; neck swollen; lid strongly rostrate.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 1597.*; (*Moug. & Nest. n. 821.*)

On alpine and subalpine rocks, sometimes on wood. Bearing fruit in early autumn.

Dioicous; forming dull-yellowish tufts. Sporangium short, striate; leaves flexuous above, opaque, not serrate at the back; beak of lid pale, not red as in the next; leaf-cells above distinct, subquadrate, but soon becoming elongated, then very narrow, rectangular at the basal angles.

6. *D. scoparium*, *Hedw.*; dioicous; loosely tufted, radiculose; leaves secund or falcato-secund, lanceolato-subulate, carinato-concave, sharply serrated at the tip; margin inflexed; nerve with projecting ridges behind, toothed above; sporangium cylindrical, slightly curved; ring none, beak long.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 354.*; (Plate 23, fig. 7); *Moug. & Nest. n. 120.*

Woods, banks, etc. Very common. Fruit in summer.

Forming yellowish tufts. Nerve of leaves with pluriscriate teeth; sporangia more or less cylindrical. The leaf-cells are much more elongated than in the last.

7. *D. majus*, *Turn.*; tufted, stems incohærent; leaves very long, falcato-secund, subulate, from a lanceolate base; fruit-stalks pale, aggregate; sporangia cernuous or horizontal, subarcuate; beak long.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 1409.*; (*Moug. & Nest. n. 1014.*)

In woods. Bearing fruit in summer.

Forming deep-green patches. Leaves in every state falcato-secund, by which character, as well as the aggregate fruitstalks and olive-brown sporangia, it is distinguished from the last; tips of leaves and nerve toothed as in the last, but the latter has more numerous ridges.

8. *D. palustre*, *Lapyl.*; tufted, radiculose; leaves spreading, glossy above, somewhat undulated, transversely linear, from a lanceolate base; toothed above; nerve slender; fruit-stalk solitary; sporangium cernuous, curved, obovate-oblong, turgid; neck substrumous; ring none.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 2260* in part.

In marshy places in woods, etc. Bearing fruit in autumn.

Monoicous or synoicous; forming large yellowish patches. Differs from the last two in the lower basal reticulations, more slender nerve without ridges, subflexuous stem, etc. The leaf-cells are altogether large; the undulations are at once visible to the naked eye; upper leaves forming a cuspidate point.

9. *D. Schraderi*, *Schwæg.*; densely tufted; stems elongated; leaves crowded, erecto-patent or subsecund, lingulate, lanceolate, rather obtuse, waved, sharply channelled, toothed; sporangium cernuous, oval oblong; lid rostrate.—*Hook. & Wils. t. xxxix.*; (*Moug. & Nest. n. 317.*)

In bogs. Cheshire and Lancashire. Bearing fruit in autumn.

Forming shining green patches. Stems sometimes a foot long, radiculose; leaves when dry curled above, toothed above as well as the margin; nerve not reaching the tip. I do not find either in English or foreign specimens the tips of the leaves subpapillose, nor is the character mentioned by Schimper. Leaf-cells nearly as in the last, but the upper ones rather more distinct.

10. *D. spurium*, *Hedw.*; loosely tufted, radiculose; leaves ovato-lanceolate, concave, suddenly linear-lanceolate, much undulated, toothed, papillose behind; nerve ceasing below the tip; sporangium cernuous, arcuate, subcylindrical, slightly strumous, striated.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 2167 in part*; (*Moug. & Nest. n. 319.*)

On heaths and bogs. Yorkshire and Scotland. Bearing fruit in June.

Synicous; forming large patches. Stems stout, rigid, dichotomous; leaves crowded, spreading, more or less imbricated when dry, and somewhat crisped; lid with a long beak; leaf-cells subpunctiform more than halfway down; papillæ distant. Habit peculiar.

*Dicranum robustum*, Blytt, is said by Schimper to have been found in a barren state near Warrington.

### 95. DICRANELLA, *Schimp.*

Veil cucullate, rather large, slightly inflated; sporangium mostly cernuous; peristome large, regular; teeth bifurcate; leaf-cells above oblongo-hexagonal, rectangular at the base; stems normally short.

1. *D. crispa*, *Schimp.*; monoicous; leaves subulate from a sheathing base, toothed at the tip, spreading and flexuous



crisped when dry; sporangium erect, striate, without any apophysis; lid long, beaked from a conical base; ring very narrow.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 1151.*

On moist sandy soil. Bearing fruit late in autumn.

Forming little pale-green patches. Stems not  $\frac{1}{2}$  an inch high; sporangium symmetrical; leaf-cells nearly uniform.

2. **D. Grevilleiana**, *Schimp.*; monoicous, densely tufted; leaves suddenly lanceolato-subulate from a wide sheathing base, somewhat undulated, spreading; perichætical leaves sheathing; sporangium cernuous, ovate, somewhat striate, obsoletely strumous; lid shortly subulate.—*Hook. & Wils. t. xxxiii.*; *Grev. Sc. Crypt. Fl. t. 116.*

On clayey soil. Scotland. Very rare. Bearing fruit in autumn.

Forming dense yellowish patches. Differs from *D. Schreberi* in the longer narrower leaves, broader nerve, monoicous inflorescence, subulate lid, etc. Leaf-cells broader and more colourless than in *D. crispa*, slightly narrower than in *D. Schreberi*, but more pellucid.

3. **D. Schreberi**, *Schimp.*; dioicous, gregarious; leaves keeled, narrowly lanceolate from a half-sheathing base, toothed towards the tip; perichætical leaves shortly sheathing; sporangium cernuous, without striæ; ring none; lid shortly rostrate.—*Hook. & Wils. t. xxxix.*; (*Moug. & Nest. n. 719.*)

On clayey or sandy soil. Scotland and north of England. Bearing fruit in autumn.

Forming yellow patches. Leaves spreading, perichætical leaves larger than the rest; base of sporangium scarcely strumous.

4. **D. squarrosa**, *Schimp.*; dioicous, tufted; stems elongated, dichotomous, radiculose; leaves oblongo-lanceolate from a sheathing base, quite entire, blunt; nerve narrow, ceasing

below the tip; sporangium cernuous, ovato-oblong; lid shortly rostrate.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 2004.*; (*Moug. & Nest. n. 320.*)

In wet rocky places near rivulets. Bearing fruit, though rarely, in autumn.

Forming dense, soft, yellow-green or brownish tufts. Stem 1–3 inches long; leaves glossy, even, scarcely changed in appearance when dry; margin plane; ring none. Leaf-cells much larger than in the other species, and more strictly hexagonal, by which small dwarf specimens of *D. Schreberi* may be known, though that species approaches the present in the type of reticulation.

5. *D. cerviculata*, *Schimp.*; tufted; leaves concave, quite entire, glossy, lanceolato-subulate from a half-sheathing base, spreading or secund; nerve depressed, dilated at the base, excurrent; sporangium cernuous, ovate, strumous below, without striæ; ring narrow; lid subulate.—*Hook. & Wils. t. xvi.*; *Eng. Bot. t. 1661, 2261, 2491.*; (*Moug. & Nest. n. 615.*)

On turfy or sandy soil. Bearing fruit in summer.

Dioicous; forming rather dense, broad, pale-yellowish patches; sporangium roundish, distinctly strumous at the base.

6. *D. varia*, *Schimp.*; gregarious; stems short; leaves spreading or subsecund, lanceolato-subulate from an oblong but not sheathing base, quite entire or obscurely toothed; nerve slightly excurrent; perichæatial leaves half sheathing; sporangium ovate, oblong, cernuous, somewhat incurved when dry, contracted below the mouth; teeth large.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 1215, 1273, 1439.*; (*Moug. & Nest. n. 412, 718.*)

On the ground, moist banks, etc. Common. Bearing fruit in autumn.

Forming broad, loose, rufous-green patches. Stems about

$\frac{1}{2}$  an inch long; lid shortly rostrate; teeth of peristome converging. A very variable species.

7. *D. rufescens*, *Schimp.*; gregarious; leaves lax, subfalcato-secund, linear-lanceolate, remotely toothed; nerve ceasing at the apex; leaf-cells large; sporangium erect, ovate, minute; lid conical, apiculate; ring none; peristome large.—*Hook. & Wils. t. xvii.*

On the ground, especially in a sandy soil. Bearing fruit in early winter.

Forming pale-reddish patches. Stems bright red; leaves more pellucid than in neighbouring species; margin plane; teeth of peristome closely barred; leaf-cells large for the size of the plant.

8. *D. subulata*, *Schimp.*; loosely tufted; stems elongated; leaves secund, more or less falcate, subulato-setaceous from an elliptic or lanceolate base, entire; sporangium eernuous, ovate, gibbous, striate when dry; lid with a long beak.—*Hook. & Wils. t. xviii.*

On the ground, in alpine or subalpine districts. Bearing fruit in autumn.

Dioicous; forming irregular, silky, green patches. Stems slender,  $\frac{1}{2}$ –1 inch high; fruitstalk red; sporangium striate; leaf-cells narrow.

9. *D. heteromalla*, *Schimp.*; densely tufted; leaves setaceous from a lanceolate base, canaliculate, quite entire, glossy; sporangium eernuous or suberect, obovate, gibbous, obliquely plicate when dry; lid with a long beak.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 1272, 2508.*; (Plate 23, fig. 8); *Moug. & Nest. n. 121.*

On banks. Common. Bearing fruit in winter.

Forming broad, silky, green patches. Fruitstalk yellowish; sporangium rufous, elongated.

96. **DICHODONTIUM**, *Schimp.*

Veil large, cucullate; ring none; sporangium roundish, on a flexuous fruitstalk, without any apophysis; peristome large, of sixteen teeth, bi-trifid; articulations crowded, prominent within; leaf-cells papillose on either side, very small above, and quadrate, those of the margin quadrate, of the base rectangular, all chlorophyllous.

1. **D. pellucidum**, *Schimp.*; stem flexuous, slightly branched; leaves squamose, linear-lanceolate from a somewhat sheathing oblong base; margin plane; nerve narrow, serrate or crenulate above and on the back; sporangium ovate, subcernuous; lid rostrate.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 1346, 2263.*; (*Moug. & Nest. n. 122.*)

On moist stones, or on the ground near rivulets. Bearing fruit late in autumn.

Dioicous; forming bright green patches. Leaves crisped when dry; sporangium roundish or ovate. Varies as to the shape of the sporangium, thickness of the beak, serrature and length of the leaves, and length of the branches. The structure of the leaves is very different from that of *Dicranum* proper.

97. **CYNODONTIUM**, *Br. & Schimp.*

Sporangium oblique or symmetrical; veil rather large cucullate; ring simple; peristome single, often irregular, of sixteen lanceolate teeth dilated at the base and often deeply cloven, free or connected by bars; leaf-cells above minute, chlorophyllous, quadrate, hexagono-oblong below and pellucid.

*a. Teeth very irregular, articulations without regular striæ.*

1. **C. Bruntoni**, *Br. & Schimp.*; cæspitose or pulvinate; leaves linear-lanceolate, keeled, concave; margin recurved,

slightly toothed above; nerve vanishing at the tip; sporangium oval, sometimes elongated, even, not sulcate when dry; teeth of peristome small, divided to the base.—*Hook. & Wils. t. xxxiv.*; *Eng. Bot. t. 2356, 2509*; *Grev. Sc. Crypt. Fl. t. 193.*; (Plate 23, fig. 9); *Moug. & Nest. n. 406.*

In crevices of alpine rocks. Bearing fruit in early summer.

Monoicous; forming soft pale-green tufts or cushions, resembling *Weissia cirrata*. Distinguished at once from the next by its even sporangium.

*b. Teeth striate.*

2. *C. polycarpum*, *Br. & Schimp.*; stem radiculose; leaves crowded, spreading or subsecund, linear-lanceolate from an oblong base, crisped when dry, toothed above, obscurely papillose; sporangium oblong, equal, deeply furrowed when dry; teeth rather irregular.—*Hook. & Wils. t. xviii.*; *Eng. Bot. t. 1977, 2269, 2279.*; (*Moug. & Nest. n. 414.*)

On alpine rocks. Bearing fruit in early summer. Scotland, Wales, and north of England.

Monoicous; forming green tufts. Leaves bent, twisted when dry, but less so than in the last species; sporangium symmetrical, more or less strumous at the base; teeth deeply cloven or perforated, striated like those of true *Dicranum*; the leaf-cells are just those of the last species.

3. *C. virens*, *Schimp.*; cæspitose; stems elongated, dichotomous; leaves lanceolato-subulate from an oblong base; margin recurved; sporangium oblong, curved, cernuous, even, distinctly strumous; lid rostrate.—*Hook. & Wils. t. xvii.*; *Eng. Bot. t. 1462.*; (*Moug. & Nest. n. 1115.*)

On moist alpine rocks. Bearing fruit in summer.

Forming loose tufts. Stems 1–3 inches high, ascending; slightly radiculose; leaves not crisped when dry; nerve thick,

subexcurrent; leaf-cells as in the last; teeth large, bright red, more finely striated than in *C. polycarpum*.

### 98. ARCTOA, *Br. & Schimp.*

Sporangium short, somewhat turbinate, on a short fruitstalk, deeply furrowed when dry; ring simple; veil cucullate, inflated; peristome single, of sixteen equidistant narrow teeth, unequally cloven or perforated, with numerous transverse bars; leaf-cells elongated, rectangular at the base.

1. *A. fulvella*, *Br. & Schimp.*—*Hook. & Wils. t.* xxxiii.; *Eng. Bot. t.* 1952, 2268; *Grev. Sc. Crypt. Fl. t.* 188.

Fissures of alpine rocks. Scotland and Wales. Bearing fruit in summer.

Monoicous; forming dense dull-green tufts. Leaves crowded, subulate, almost falcate, not crisped when dry, toothed above; nerve strong; lid obliquely rostrate; teeth striated like those of *Dicranum*.

### 99. BLINDIA, *Br. & Schimp.*

Sporangium roundish, turbinate when dry; veil at first 4-6-gonal at the base, then cucullate; ring none; peristome single, of sixteen equidistant entire or cribrose teeth, sometimes cloven above, slightly trabeculate; leaf-cells minute above, rectangular, gradually larger downwards, those at the angles hyaline, very much dilated, with a distinct primordial membrane.

1. *B. acuta*, *Br. & Schimp.*—*Hook. & Wils. t.* xv.; *Eng. Bot. t.* 1644, 2552.; (Plate 24, fig. 1); *Moug. & Nest. n.* 610.

On moist alpine or subalpine rocks. Bearing fruit in summer.

Dioicous; forming dark tufts. Stems varying much in length; leaves subsecund, glossy, lanceolato-subulate; nerve reaching to the tip, which is minutely toothed or excurrent; teeth red, not striate as in *Dicranum*; lid obliquely rostrate.

100. **STYLOSTEGIUM**, *Br. & Schimp.*

Sporangium roundish, immersed; veil short, cucullate, scarcely covering the lid; columella thick, falling away with the lid; peristome none; leaf-cells oblong, enlarged downwards.

1. *S. cæspiticium*, *Br. & Schimp.*—*Hook. & Wils. t. xxxviii.*; *Eng. Bot. t. 2778.*

In the crevices of alpine rocks. Ben Lawers. Rare. Bearing fruit in autumn.

Monoicous; forming dense tufts. Leaves somewhat falcate and secund, subulate or acuminate from an ovato-lanceolate base; nerve thick, excurrent; fruitstalk very short; lid rostrate; sporangium not striate.

ORDER XXX. *WEISSIEI*, Mont.

Sporangium erect, equal; veil cucullate; peristome wanting or consisting of sixteen teeth, often united at the base; leaf-cells in general minute above and quadrate, elongated and rectangular below.

101. **ANODUS**, *Br. & Schimp.*

Sporangium symmetrical, straight, truncato-ovate, columella inserted after the fall of the lid; peristome none; veil cucullate.

1. *A. Donianus*, *Br. & Schimp.*—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 1582.*

On rocks and stones, especially those which are arenaceous. Not common. Scotland and north of England. Bearing fruit in autumn.

Monoicous; extremely small, gregarious. Leaves lanceolato-subulate, minutely toothed; leaf-cells oblong, hexagonal, rather lax, nearly uniform, very different from those of *Seligeria*; sporangium symmetrical, truncate, ovate; ring none; lid conical; columella exerted when dry.

### 102. SELIGERIA, *Br. & Schimp.*

Sporangium roundish, wide-mouthed; ring none; veil small, cucullate; peristome single, of sixteen equidistant, lanceolate, obtuse, entire teeth, sometimes perforated; without any medial line. *Minute, nearly stemless, monoicous Mosses.*

1. *S. pusilla*, *Br. & Schimp.*; leaves lanceolate, subulate, somewhat toothed in the middle; fruitstalk straight; teeth remotely barred.—*Hook. & Wils. t. xv.*; (*Moug. & Nest. n. 1005.*)

On nearly vertical rocks, especially those which are calcareous. Ireland and north of England. Bearing fruit in spring.

Gregarious, bright green. Leaves with a broad, excurrent, predominant nerve; leaf-cells oblong, rectangular, often confined to the margin, all the rest being occupied by the nerve.

2. *S. calcarea*, *Br. & Schimp.*; leaves rather short, lanceolate from an oblong base, blunt (or subacute); nerve thick; fruitstalk rather thick; lid short; teeth densely barred.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 191.*; (Plate 24, fig. 2.)

On the steep sides of chalk pits. Bearing fruit in spring.

Distinguished from the last by its broader leaves, thicker nerve, thicker fruitstalk, shorter beak, and broader, more closely articulated teeth. Leaf-cells much as in the last.



3. *S. tristicha*, *Br. & Schimp.*; densely tufted; leaves tristichous, crowded, rigid, narrowly lanceolate, blunt, whitish at the base; sporangium subspherical; neck swollen, truncate when the rostrate lid has fallen; teeth narrow.—*Bryol. Eur. t. iii.*

On calcareous rocks. Blair Athol.

The exactly tristichous arrangement of the leaves is characteristic of this species.

4. *S. recurvata*, *Br. & Schimp.*; tufted; stems very short; leaves lanceolato-subulate from an oval or oblong base; veil rather large; sporangium drooping on a curved fruitstalk, oval or oblong; lid convex, ending in a short straight beak; teeth often bifid.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 1489, 2551.*

On rocks, especially sandstone. Bearing fruit in spring.

Leaves somewhat waved; sporangium erect when dry, rather loosely cellular; lid straighter, veil larger. Mr. Mitten has another species, *S. calcicola*, which I have not seen, and which by some is supposed to be the true *Weissia pusilla* of Bridel, though Schimper thinks otherwise.

### 103. BRACHYODUS, *Nees & Hornsch.*

Sporangium erect, on a straight fruitstalk, small, furrowed when dry; ring broad; veil conical, subcucullate; peristome single, of sixteen very short, truncate, equidistant, partly confluent teeth.

1. *B. trichodes*, *Nees & Hornsch.*—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 2563.*; (Plate 24, fig. 3); *Moug. & Nest. n. 711.*

On moist sandstone or granite rocks. Generally in sub-alpine countries. Bearing fruit in spring or late in the autumn.

Monoicous; very small. Leaves lanceolato-subulate, nerve rounded, excurrent; veil five-lobed at the base, one fissure

extending nearly to the apex; lid shortly rostrate; ring very broad, compound, persistent; teeth rather broad, confluent at the base, hyaline, slightly pierced; lid crenulate at the base, edged with red; leaf-cells distinct, oblong, subrectangular, those at the basal wings hexagonal and sienna-brown; teeth scarcely rising beyond the ring.

#### 104. **CAMPYLOSTELIUM**, *Br. & Schimp.*

Sporangium pendulous, on a curved fruitstalk, even; veil conico-subulate, five-cleft, covering the lid; ring double; peristome single, of sixteen lanceolate, long, trabeculate teeth, connected at the base, cloven above.

1. **C. saxicola**, *Br. & Schimp.*—*Hook. & Wils. t. xiii.*; *Eng. Bot. t. 2627.*; (Plate 24, fig. 4.)

On sandstone rocks. Dublin and England. Rare. Bearing fruit in autumn.

Monoicous; very short. Leaves linear, concave, from an oval base, keeled, reddish, twisted when dry; nerve thick, scarcely reaching the apex; sporangium on a rather long fruitstalk, elliptico-oblong; teeth erect when moist, forming a cone, incurved when dry, red, more or less regularly cloven; leaf-cells very distinct, quadrate above, with thick walls, rectangular below.

#### 105. **RHABDOWEISSIA**, *Br. & Schimp.*

Sporangium erect, striate, furrowed when dry; veil cucullate; peristome single, of sixteen narrow teeth, closely articulated, without a medial line; ring very narrow; leaf-cells subquadrate above, rectangular and pellucid below.

This is now reduced by Schimper to a subgenus of *Weissia*.

1. **R. fugax**, *Br. & Schimp.*; pulvinato-cæspitose; leaves linear-lanceolate, keeled; margin plane; fruitstalk very short;

sporangium very small, roundish; lid rostrate.—*Hook. & Wils. t. xv. ; Eng. Bot. t. 1988. ; (Moug. & Nest. n. 407.)*

In crevices of rocks, especially such as are arenaceous or granitic, and on moist banks in subalpine districts. Bearing fruit in summer.

Monoicous; forming irregular, yellowish cushions. Leaves long, flexuous, recurved, crisped when dry, entire or slightly toothed; nerve large, vanishing below the tip; leaf-cells distinct, with thick walls, subquadrate, rectangular and hyaline below; teeth almost filiform above, from a lanceolate base, fugacious.

2. *R. denticulata*, *Br. & Schimp.*; tufted; leaves linear-lanceolate or lingulate, strongly toothed above, keeled; sporangium apophysate.—*Hook. & Wils. t. xv. ; (Plate 24, fig. 5.)*

In crevices of alpine and subalpine rocks. Bearing fruit in summer.

Monoicous; forming irregular, green patches. Stems stouter than in the last; leaves crisped when dry, far less attenuated, often strictly lingulate, strongly toothed above; leaf-cells as in the last, but larger and not so full of chlorophyll, so that the leaves are more transparent, especially below; sporangium larger, subglobose, with a more distinct apophysis, less deeply sulcate when dry; lid subulate; teeth narrow, from a lanceolate base, persistent.

#### 106. WEISSIA, *Hedw.*

Sporangium without striae, on a long straight fruitstalk; ring persistent; peristome single, of sixteen equidistant, narrow teeth, mostly free at the base, transversely barred, without a medial line, entire, bifid or perforated; leaf-cells very minute above.

1. *W. controversa*, *Hedw.*; caespitose; leaves linear-lan-

ceolate; margin more or less involute; nerve slightly excurrent; sporangium oval or ovato-oblong; lid rostrate; ring narrow.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 1367.*; (Plate 24, fig. 6); *Moug. & Nest. n. 16.*

In pastures, fallow fields, etc. Bearing fruit in spring.

Monoicous; more or less tufted. Extremely variable, but known by the more or less involute margin. Distinguished from *Gymnostomum microstomum* by the presence of a peristome, which is, however, sometimes almost rudimentary; leaf-cells extremely minute and crowded above, then more distant and quadrate; rectangular and pellucid at the base.

2. *W. mucronata*, *Br. & Schimp.*; leaves lanceolate or linear-lanceolate, concave above, with a plane margin; nerve excurrent; sporangium oblong, obscurely striate; teeth short, truncated, cloven or perforated, fugacious.—*Hook. & Wils. t. xxxviii.*

In clay fallow fields. Bearing fruit in spring.

Distinguished from the last by the nearly plane margin of the leaves, the more excurrent nerve, rather wider leaves, longer, slightly striate sporangium, more fugacious peristome, and larger spores.

3. *W. cirrhata*, *Hedw.*; pulvinate; stems much branched; leaves spreading, linear-lanceolate from an oblong, concave base, channeled above, crisped when dry; margin reflexed; sporangium oblong, subcylindrical; ring compound; lid rostrate.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 1420.*; (*Moug. & Nest. n. 907.*)

On the tops of gateposts, rails, etc.; sometimes on rocks. Bearing fruit in early spring.

Monoicous; forming soft, green cushions. Leaves spreading, assurgent from the middle; margin reflexed; sporangium brownish, with a rosy orifice; teeth linear from a lanceolate

base, red, entire; leaf-cells above minute, but distinct, sub-quadrangle, gradually larger downwards, elongated, and more hyaline at the base.

4. *W. crispula*, *Hedw.*; tufted, branched; leaves spreading or secund, lanceolato-subulate from a broad concave base, crisped when dry; margin plane; sporangium oval or oblongo-ovate; ring none; lid rostrate.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 2203.*; (*Moug. & Nest. n. 812.*)

In crevices of alpine rocks. Bearing fruit in summer.

Monoicous; cæspitose or pulvinate. Distinguished by the plane margin of the leaves, which are longer and narrower above, the less cylindrical sporangium, etc. Leaf-cells as in the last.

5. *W. verticillata*, *Brid.*; stems fastigate; leaves narrow, linear-lanceolate, toothed below; margin plane, granulated above; nerve strong, slightly excurrent; teeth oblique; lid rostrate.—*Hook. & Wils. t. xv.*; *Eng. Bot. t. 1258.*; (*Moug & Nest. n. 507.*)

On dripping calcareous rocks and stones. Bearing fruit in summer.

Dioicous; forming dense tufts, often incrustated with a calcareous deposit. Leaves glaucous, scarcely crisped when dry; leaf-cells quadrate above, distinct, rectangular below; sporangium ovate; teeth inclined to the right-hand, deciduous.

This constitutes the genus *Eucladium*, Br. & Schimp., but I think Wilson has done right in retaining it in *Weissia*.

#### 107. GYMNSTOMUM, *Hedw.*

Sporangium erect, on a straight fruitstalk; veil large, cucullate, rostrate; peristome none, but sometimes the ring of the sporangium remains attached to the top of the columella.

\* *Dioicous*; leaves nearly straight when dry.

1. *G. tenue*, *Schrad.*; tufted; leaves elongated, linear, acuminate above; perichætical leaves sheathing beyond the middle; sporangium oblong; lid shortly rostrate; ring rather broad.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 2506.*; (*Moug. & Nest. n. 810.*)

On sandstone rocks, etc. Glasgow and Cheshire. Bearing fruit in summer.

Forming broad, pale-green patches. Stems very short; leaves somewhat translucent, suberect; nerve ceasing below the apex; margin granulated; leaf-cells minute above, quadrate or subrotund, gradually more elongated downwards; mouth of sporangium red, slightly contracted.

2. *G. rupestre*, *Schwæg.*; tufted, subpulvinate; stems dichotomous; leaves spreading, assurgent, linear-lanceolate, obtuse or slightly acute; nerve thick, ceasing below the tip; sporangium oval; lid conical, with a short beak.—*Hook. & Wils. t. xxxii.*; *Eng. Bot. t. 2200.*; (*Moug. & Nest. n. 1102.*)

Crevices of wet alpine or subalpine rocks. Bearing fruit late in summer.

Forming more or less dense brownish-green cushions. Leaves rather rigid; sporangium thin, truncated when the lid has fallen; leaf-cells subquadrate, slightly larger at the base and hyaline; those of the margin granulated.

3. *G. curvirostrum*, *Hedw.*; tufted; leaves spreading, nearly straight or variously curved, linear-lanceolate, acute, concave below; margin even, recurved; sporangium broadly ovate; lid obliquely rostrate, longer than the sporangium and adhering to the columella.—*Hook. & Wils. t. vi.*; *Eng. Bot. t. 2202, 2214.*; (*Moug. & Nest. n. 905.*)

Moist alpine and subalpine rocks. Bearing fruit towards the end of summer.

Forming brownish-green patches. Stems elongated; leaves slightly incurved when dry, scarcely twisted, more acute than in the last; leaf-cells distinct, subquadrate, gradually elongated downwards; the marginal cells above slightly granulose; lid very long; sporangium with a red shining orifice.

\*\* *Monoicous; leaves crisped when dry; margin incurved or plane.*

*a. Spore-sac united to the top of the columella.*

4. **S. squarrosus**, *Nees & Hornsch.*; loosely tufted; leaves squarrose, linear-lanceolate, mucronate from the excurrent nerve, crisped when dry; margin plane; sporangium elliptic or ovate, exserted; fruitstalk rather short; lid acutely beaked.—*Hook. & Wils. t. xxxviii.*; (Plate 24, fig. 7); *Moug. & Nest. n. 906.*

In clayey fields and on banks. Lancashire and Cheshire. Bearing fruit in autumn and winter.

Forming deep-green patches. Stems forming innovations from the procumbent plant of last year; spores opaque, brown; leaf-cells compact, minute above, gradually larger below.

Distinguished from *G. microstomum* by the plane margin and excurrent nerve.

5. **G. microstomum**, *Hedw.*; densely tufted; leaves elongato-lanceolate, crisped when dry; nerve excurrent; margin incurved; sporangium exserted, elliptic; mouth contracted; lid rostrate.—*Hook. & Wils. t. vii.*; *Eng. Bot. t. 2215.*; (*Moug. & Nest. n. 608.*)

On clayey or sandy soil. Bearing fruit in spring.

Forming dull-green patches. Stems short, fastigate; leaves spreading, recurved below, incurved above; lid conical or rostrate; leaf-cells as in the last.

Varying in size, length of leaves, form of sporangium, and inclination.

*Adocia  
micro*

6. *G. rostellatum*, *Schimp.*; leaves linear-lanceolate, erectopatient and curved, mucronate from the excurrent nerve, minutely papillose, crisped when dry; sporangium immersed, elliptic; lid very persistent, at length deciduous, obliquely rostrate.—*Hook. & Wils. t. xxxviii.*; *Eng. Bot. t. 2831.*; (*Moug. & Nest. n. 903.*)

On dried beds of pools. North and south of England. Bearing fruit in autumn and early spring.

Slightly cæspitose. Leaf-cells as in *G. squarrosum*, from which it differs principally in its immersed fruitstalk.

*b. Spore-sac not adherent.*

7. *G. tortile*, *Schwæg.*; tufted, branches fastigate; leaves crowded, slightly crisped when dry, oblongo-lanceolate, obtuse, apiculate; margin incurved; nerve strong; sporangium elliptic; lid rostrate.—*Hook. & Wils. t. xxxviii.*; (*Moug. & Nest. n. 1003.*)

On calcareous rocks. Derbyshire, Sussex, Cornwall. Bearing fruit in spring.

Forming irregular, dense tufts. Nerve of leaves strong, reddish.

Differs from the last in its stouter habit, wider leaves, thicker nerve, thicker sporangium, wider mouth, beneath which it is slightly constricted. Leaf-cells as in the last.

108. **SYSTEGIUM**, *Schimp.*

Sporangium immersed or subimmersed on a very short fruitstalk, symmetrical; lid persistent, but separating easily from the ripe sporangium; spores globose, rather small.

1. *S. crispum*, *Schimp.*; stem short, subdivided; leaves linear-lanceolate, mucronate from the excurrent nerve, crisped and curled when dry; margin involute, minutely papillose



behind.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 1680.*; (*Moug. & Nest. n. 703.*)

In calcareous fields. Bearing fruit in spring.

Monoicous; forming yellowish-green patches. Stem more or less divided; sporangium elliptic or subglobose, generally immersed, but sometimes exserted on the same plant; leaf-cells and spores exactly as in *G. squarrosum*.

2. *S. multicapsulare*, *Schimp.*; stems elongated, loosely tufted; leaves distant, widely spreading, slightly crisped when dry, lanceolate, apiculate; margin plane; perichæatial leaves erect; sporangia roundish, immersed, often in pairs; lid somewhat obliquely rostrate.—*Hook. & Wils. t. xxxvii.*; *Eng. Bot. t. 618.*

In fields. Bedfordshire, Yorkshire, and Cheshire. Bearing fruit in early spring.

Monoicous; forming dull-green patches. Stem more or less branched, elongated,  $\frac{1}{2}$  an inch or more long; perichæatial leaves wider, not crisped when dry and not suddenly acuminate; sporangia sometimes in pairs; veil large; leaf-cells large and less opaque.

3. *S. Mittenii*, *Schimp.*; stems elongated; leaves linear-lanceolate, scarcely crisped when dry; perichæatial leaves small, spreading; sporangia solitary, somewhat exserted, ovate; lid minute, rostrate; spores larger.

On clay banks. Hurstpierpoint, Sussex. Bearing fruit in spring.

The larger spores, more solid leaves, smaller spreading perichæatial leaves, seem to indicate a distinct species. The longer fruitstalk, solitary sporangia, and situation of the male flowers at the base of the fertile innovation are perhaps characters of less value.

ORDER XXXII. *PHASCEI*, Mont.

Sporangium sessile or shortly pedunculate, with or without a columella, indehiscent without any trace of peristome; lid confluent with the walls of the sporangium; veil mitriform or cucullate.

109. *PLEURIDIUM*, *Brid.*

Sporangium on a short fruitstalk, lateral after innovation, shortly apiculate; veil cucullate; leaf-cells above narrow-linear, below oblong.

1. *P. nitidum*, *Br. & Schimp.*; stem delicate; leaves lanceolate or linear-lanceolate, erecto-patent, obscurely toothed above; nerve rounded, vanishing below the apex; sporangium oval.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 1036, 2093.*; *Moug. & Nest. n. 605.*)

In moist fields and soil of dried-up pools. Bearing fruit in autumn and spring.

Monoicous; male flowers produced in the axils of the perichæatial leaves, minute. Stems 1–6 lines long, producing innovations frequently below the fruit, and thus bearing two or three crops of fruit in the same year; leaf-cells quite different from those of the last genus; spores nearly of the same size and colour, but not so globose. Varying with a shorter stem, narrower leaves, and roundish sporangium.

2. *P. subulatum*, *Schimp.*; leaves lanceolate, erecto-patent or subsecund; perichæatial leaves lanceolato-subulate; nerve rather broad, ceasing near the tip; sporangium immersed, roundish, ovate.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 2177.*; (*Moug. & Nest. n. 112.*)

On the ground, in fields, etc. Common. Bearing fruit in spring.

Monoicous; yellow or dull-green, mostly simple. Nerve

predominating ; fruitstalk very short, straight ; leaf-cells as in the last ; spores larger.

3. *P. alternifolium*, *Br. & Schimp.* ; stem-leaves distant, lanceolato-acuminate ; perichætical leaves subulato-setaceous, both from a dilated base ; nerve thick, excurrent ; sporangium ovate, immersed ; male flowers gemmiform.—*Hook. & Wils. t. xxxvii.* ; (*Moug. & Nest. n. 707.*)

In fallow fields, etc. Scotland, with the north and south of England. Bearing fruit in spring.

Monoicous ; forming little brownish tufts. The plant of the first year short, that of the second an inch long from innovations ; leaves minutely toothed above. Differs from the last in the wider base of the leaves, the more predominant nerve, the gemmiform male flowers, and the larger ovate sporangium ; leaf-cells shorter than in the two last. The two-years-old plant with its flagelliform innovations has a very different appearance from that of the first year.

#### 110. PHASCUM, *Linn.*

Sporangium produced into an obtuse beak or apiculus ; columella persistent, veil regularly cucullate ; male flowers axillary ; antheridia naked, sometimes gemmiform ; prothallus not permanent ; leaf-cells subrectangular or minute and subquadrate, more elongated towards the base.

1. *P. cuspidatum*, *Schreb.* ; stem radiculose, simple or branched ; leaves ovato-lanceolate or lanceolate and cuspidate, erect, keeled, concave, hair-pointed from the excurrent nerve ; sporangium roundish on a short fruitstalk, immersed.—*Hook. & Wils. t. v.* ; *Eng. Bot. t. 2025, 2026, 2259.* ; (*Moug. & Nest. n. 307.*)

On the ground, especially in a sandy soil. Common. Bearing fruit in early spring.

Monoicous; light-green, short or branched. Leaves somewhat papillose on either side; margin reflexed; sporangium obscurely beaked; veil conico-campanulate or cucullate; leaf-cells rather lax, subrectangular, longer at the base. Varying immensely in the length of the stem, the length, direction, and form of the leaves, the curvature and length of the fruit-stalk, the form of the sporangium, etc.; spores strongly echinulate.

2. *P. bryoides*, *Dicks.*; simple or branched; upper leaves erecto-patent or connivent, ovato-lanceolate, concave; margin reflexed; nerve excurrent, forming a long mucro; sporangium elliptic, exserted, obliquely apiculate.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 1180.*; (Plate 24, fig. 8); *Moug. & Nest. n. 705.*

Open fields; generally rare, but very common in some parts of Northamptonshire in company with other *Phasca*. Bearing fruit in spring.

Monoicous; forming little green or brownish-green tufts. Lid of sporangium variable in length; leaf-cells as in the last.

### 111. **BRYELLA**, *Berk.*

Sporangium roundish, exserted; lid distinctly defined, though scarcely dehiscent, with an adnate ring of thirty-two cells; veil cucullate, scabrous above; leaf-cells crowded above and chlorophyllose.

The definite lid and evident ring seem to require the separation of this from *Phascom*, if the genus is to be divided. In the leaf-cells it approaches nearer to the old *P. curvicollum*, in which however the characters of the lid are different.

1. *B. recta*, *Berk.*—*Hook. & Wils. t. v.*; *Eng. Bot. t. 330.*; (*Moug. & Nest. n. 804.*)

Banks, fields, etc., especially near the sea, affecting more southern latitudes. Bearing fruit in winter or early spring.

Monoicous. Stem very short; leaves spreading, elliptic, lanceolate, with an excurrent nerve, distinctly papillose at the back; margin recurved; sporangia on straight elongated fruitstalks, often aggregate, chestnut-brown; leaf-cells less translucent than in *Phascum*; spores small, pale, echinulate.

### 112. *CYCNEA*, Berk.

Sporangium on a curved fruitstalk, globose, confluent with the lid; veil dimidiate, even; spores even, translucent; leaf-cells minute above and crowded, subquadrate, elongated below; antheridia axillary, naked.

The translucent, smooth spores, indicated by Hedwig, are extremely different from the globose, strongly echinulate spores of *Phascum cuspidatum*, which, together with the curved fruitstalk, different inflorescence and reticulation, indicate a distinct genus.

1. *C. curvicolla*, Berk.—Hook. & Wils. t. v.; Eng. Bot. t. 905.; (Moug. & Nest. n. 606.)

In open fields, on tops of walls, etc. Bearing fruit in spring.

Monoicous; densely gregarious, reddish. Stem very short; leaves crowded, erecto-patent, elongato-lanceolate; nerve strongly excurrent; margin reflexed; sporangia sometimes aggregate; spores yellowish. Hedwig figures them with a short peduncle, like that in *Bovista*, which I have not seen, and Greville figures a similar structure in *Leptotrichum glaucescens*.

### 113. *SPHÆRANGIUM*, Schimp.

Sporangium spherical, erect, on a very short fruitstalk or pendulous; veil erect, mitriform, fugacious; columella rather thick; spore-sac separable; spores large, subglobose, minutely granulated; leaf-cells large; leaves hyaline; prothallus not permanent; male flowers rooting.

1. *S. muticum*, *Schimp.*; stem very short; leaves widely ovato-acuminate, concave, connivent; nerve rarely excurrent; sporangium erect, immersed.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 2027.*; (*Moug. & Nest. n. 1204.*)

In fallow fields, etc. Bearing fruit in autumn and spring.

Dioicous; gregarious, dull-green or brownish. Leaves very broad and concave, forming a little ovate, pointed, bulb-like mass, toothed or entire above; margin plane; perichætical leaves convolute; spores pale, globose; leaf-cells smaller than in the next species.

2. *S. triquetrum*, *Schimp.*; stem very short; leaves tristichous, connivent, obovate, boat-shaped, strongly keeled; margin reflexed; nerve excurrent, the tip recurved; sporangium horizontal on a long, slender, curved fruitstalk, immersed.—*Hook. & Wils. t. xxxvii.*; *Eng. Bot. t. 2901.*; (*Moug. & Nest. n. 802.*)

On the ground, at the top of cliffs, near the sea. Sussex. Bearing fruit in spring.

Monoicous; gregarious at first, pale-green, then reddish. Leaves very concave, closely embracing the sporangium and forming a subglobose bulb-like mass; the subdimidiate veil soon parts from the sporangium, and often adheres by the entire side to the vaginula; leaf-cells and spores larger.

#### 114. MICROBRYUM, *Schimp.*

Sporangium immersed, roundish-ovate on a very short fruitstalk, with a blunt beak or apiculus; veil large, many-lobed, erect; leaf-cells small, rhomboid.

1. *M. Flœrkeanum*, *Schimp.*—*Hook. & Wils. t. xxxvii.*; *Eng. Bot. t. 2887.*

In fields. Durham, Yorkshire, and Sussex. Bearing fruit late in autumn.

Monoieous ; gregarious or slightly tufted, brownish. Leaves crowded, erecto-patent, ovato-aecuminate, minutely papillose at the back ; margin reflexed ; nerve excurrent ; spores small, pale ; antheridia naked, axillary ; leaf-cells much smaller than in *Sphærangium* and shorter ; spores small, pale.

#### 115. **PHYSCOMITRELLA**, *Schimp.*

Sporangium globose, minutely apiculate ; columella thick ; veil campanulate, subvesicular when young ; leaf-cells large, hyaline.

1. **P. patens**, *Schimp.*—*Hook. & Wils. t. v. ; Eng. Bot. t. 1279. ; (Plate 24, fig. 9) ; Moug. & Nest. n. 704.*

Fields, banks, and dried-up pools. Bearing fruit in the autumn.

Monoicous ; gregarious, pale-green. Stem 1–3 lines high ; leaves spreading, lower scattered, upper crowded, concave, broader above ; nerve slight, ceasing below the tip ; sporangium spherical with a minute point ; spores rather larger, echinulate ; leaves crumpled when dry ; leaf-cells large.

#### 116. **EPHEMERELLA**, *Schimp.*

Prothallus persistent ; sporangium immersed, confluent with the lid ; veil regularly cucullate ; spores large ; leaf-cells sub-hexagonal above, more rectangular below.

1. **E. recurvifolia**, *Schimp.*—*Hook. & Wils. t. xxxvii. ; Eng. Bot. t. 2932 ; Grev. Sc. Crypt. Fl. t. 353. ; (Moug. & Nest. n. 902.)*

In fallow fields, heaths, etc. Durham, Northamptonshire, Surrey, and Sussex. Bearing fruit in winter.

Gregarious, dark-green. Leaves lingulate or linear-lanceolate, recurved or erect, toothed above ; nerve excurrent ; sporangium ovate, sessile, thick-walled.

117. **EPHEMERUM**, *Hampe*.

Prothallus persistent; sporangium immersed, confluent with the lid; veil mitriform; spores large; leaf-cells large, hyaline, rhomboido-hexagonal.

1. **E. serratum**, *Müll.*; leaves lanceolate, toothed; nerve less connivent; sporangium sessile, subglobose.—*Hook. & Wils. t. v.*; *Eng. Bot. t. 460, 2106.*; (*Moug. & Nest. n. 803.*)

On the naked soil, whether sandy or argillaceous. Bearing fruit in winter and early spring.

Monoicous; prothallus dense. Stem scarcely any; leaves suberect, sharply toothed or almost spinulose, sometimes linear-lanceolate and obscurely toothed, hyaline; spores yellow; leaf-cells much elongated.

2. **E. cohærens**, *Müll.*; leaves ovato-lanceolate, erect, keeled; nerve reaching to the tip; sporangium immersed, sessile.—*Hook. & Wils. t. xxxvii.*

On the ground. Hurstpierpoint, Sussex, Mr. Mitten. Bearing fruit in winter.

Prothallus abundant. Leaves sometimes nerveless, toothed above, the lower ones nearly nerveless; sporangium subspherical, pale; veil mitriform, covering a third part of the sporangium.

3. **E. sessile**, *Br. & Schimp.*; leaves rather rigid, suberect or subsecund, linear-lanceolate, narrow, mostly toothed above; nerve excurrent; sporangium sessile, immersed, small, roundish.—*Hook. & Wils. t. xxxvii.*; *Eng. Bot. t. 2829.*

On clayey or chalky soil. Sussex and Cheshire. Bearing fruit in autumn and winter.

Monoicous; prothallus abundant. Nerve predominant above; leaf-cells not so elongated as in *E. serratum* and smaller; veil mitriform.



118. **ARCHIDIUM**, *Bridel*.

Sporangium globose, sessile on the short tumid vaginula, without any lid; columella fugacious; spores very large, few in number; veil irregular, torn in the middle.

1. **A. phascoides**, *Brid.*—*Hook. & Wils. t. v.*; *Eng. Bot. t. 2107.*; (Plate 24, fig. 10); *Moug. & Nest. n. 904.*

In heaths and fields. Bearing fruit in spring.

Monoicous. Stem at first short, sending off innovations for one or two years from the base of the female flowers; sterile shoots flagelliform with scattered, minute, shorter leaves; fertile stem stouter; leaves lanceolate, entire; nerve ceasing below the minutely toothed tip; perichætical leaves larger, toothed above; spores from eight to sixteen in each sporangium, subglobose-tetrahedric, with one convex and three or four flat sides; veil membranous; leaf-cells lax, subhexagonal, elongated, nearly uniform.

## FAMILY III.—SYNCLADEI.

Branches fasciculate; fruit cladocarpous.

ORDER XXXIII. *SPHAGNEI*, Mont.119. **SPHAGNUM**, *Dill.*

Sporangium globose; receptacle elongated, fleshy; peristome none; veil ruptured near the middle; leaf-cells of two kinds, the one large, containing a spiral thread, the walls perforated between the spirals; the other linear, surrounding the first; prothallus scale-like.

\* *Leaves obtuse.*

1. **S. cymbifolium**, *Ehr.*; stem robust, mostly bipartite;

branchlets turgid, obtuse, spreading, two or three together, flagelliform, pendulous and more or less adpressed to the stem; stalk-leaves lingulate, rounded at the tip; branch-leaves broadly ovate; margin incurved above; tip scabrous; utricles of branches lined with spiral fibres.—*Hook. & Wils. t. iv.*; *Eng. Bot. t. 1405.*; (Plate 2, fig. 1); *Moug. & Nest. n. 113.*

Peat-mosses. Bearing fruit in summer.

Dioicous. Stem often much elongated; branches obtuse; leaves mostly white, sometimes reddish; utricles of stem and branches lined with spiral lines, perforated or imperforate.

2. *S. compactum*, *Brid.*; stems densely tufted; branches crowded, short, mostly in pairs; leaves ovate, attenuated upwards, eroded at the tip and toothed; utricles of stem without spiral threads.—*Hook. & Wils. t. lxi.*; (Plate 22, fig. 2); *Moug. & Nest. n. 805.*

Wet moors. Bearing fruit in late summer.

Known by its densely tufted habit, short branches, longer eroded leaves, and especially by the want of all trace of spiral threads in the utricles of the stem. Pores of cells smaller than in the last.

3. *S. molluscum*, *Bruch.*; stem soft; leaves roundish-oval; utricles of stem recurved above; sporangium small, thin.—*Hook. & Wils. t. lx.*; (*Moug. & Nest. n. 808.*)

Wet boggy spots. Bearing fruit in early summer.

Forming short pale-yellow tufts. Branches mostly three together, spreading or deflexed; the tips of the external utricles, which are without spiral threads, free above and recurved, with a terminal pore; tip of leaves slightly eroded and toothed; sporangium small; spores yellow.

4. *S. rubellum*, *Wils.*; dioicous; branches short, attenuated, deflexed; leaves elliptic, obtuse; fruitstalk short.—*Hook. & Wils. t. lx.*

In peat-mosses with other species.

Distinguished from *S. acutifolium* by its smaller size, obtuse elliptic leaves, dioicous inflorescence, and deep-red perigonia.

\*\* *Leaves acuminate.*

5. *S. acutifolium*, *Ehr.*; branches slender, attenuated, spreading; stem-leaves ovate, erect; branch-leaves ovato-lanceolate, tapering, crotched, erecto-patent; sporangium on a long stalk.—*Hook. & Wils. t. iv.*; *Eng. Bot. t. 1406.*; (Plate 2, fig. 4); *Moug. & Nest. n. 11.*

In swamps. Bearing fruit in summer.

Monoicous. Leaves often lilac; stalk of sporangium very long; spores ferruginous.

A very variable species, from a few inches to a foot in length. Male flowers purple, perichaetial leaves thin, convolute, without pores or fibres, acute.

6. *S. fimbriatum*, *Wils.*; stem much elongated; branches very slender, pendulous; stem-leaves large, close-pressed, obovate, laciniate; branch-leaves ovato-lanceolate; perichaetial leaves large, obovate, obtuse; sporangium on a short stalk.—*Hook. & Wils. t. lx.*

In swamps. Bearing fruit abundantly in summer.

Monoicous. Leaves never red; stem-leaves without pores and fibres; perichaetial leaves solid.

7. *S. cuspidatum*, *Ehr.*; stem elongated; branches fasciculate, attenuated, some deflexed, closely adpressed; stem-leaves ovate, acute, spreading; branch-leaves lanceolate, tapering; margin undulated when dry.—*Hook. & Wils. t. lxi.*; *Eng. Bot. t. 2092.*; (*Moug. & Nest. n. 405, 1306.*)

In deep peat-mosses.

Distinguished from the two last by its longer, more loosely imbricated leaves, which are undulated when dry, changing

rather to ferruginous than purple. Extremely variable; in the plumose variety the leaves are very narrow and much elongated (*Hook. & Wils. t. iv.*).

8. *S. recurvum*, *P. Beauv.*; stem elongated, branchlets spreading with short, oblongo-lanceolate, erecto-patent, plane leaves, recurved when dry; margin undulated.—*S. Mougeotii*, *Moug. & Nest. n. 1306.*

Growing intermixed with *S. cuspidatum*, *W. Wilson*. Bearing fruit in summer.

9. *S. contortum*, *Schultz*; stem dark, with a simple layer of cortical cells; branches recurved; stem-leaves broadly ovate, branch-leaves acuminate, ovato-lanceolate, often subsecund; cells crowded; pores biseriate, minute, numerous.—*Hook. & Wils. t. lx.*; (*Moug. & Nest. n. 806, 807.*)

In peat-mosses. Bearing fruit in July.

Monoicous, often slightly fawn-coloured, variable, but distinguished by the brownish colour of the main stem, the simple layer of cortical cells, and the biseriate minute pores. The spiral threads often become reticulate. The branches are sometimes but not always contorted, and in the variety *obesum* they are swollen as in *S. cymbifolium*.

In Spruce's variety *δ laricinum*, however, there is more than one cortical layer, but there are still the same minute pores. *Wilson* however suspects that this may prove eventually distinct.

10. *S. squarrosum*, *P.*; stems elongated; cortical stratum double, not porous; branchlets horizontal and deflexed; cortical cells slightly prominent above; leaves ovate, acuminate, recurved, squarrose; pores large.—*Hook. & Wils. t. iv.*; *Eng. Bot. t. 98.*; (*Plate 2, fig. 5*); *Moug. & Nest. n. 209.*

In bogs. Bearing fruit in summer.

Monoicous; grass-green above; easily known by its squar-

rose, ovato-acuminate leaves. The squarrose varieties of *H. cymbifolium* and *cuspidatum* may be known by their leaves.

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FAMILY IV.—SCHISTOCARPI.

Sporangium quadrifid or multifid; receptacle elongated.

ORDER XXXIV. *ANDREÆI*, Lindl.

120. *ANDREÆA*, Ehr.

Fruit acrocarpous; receptacle elongated; sporangium sessile, four-cleft or four-valved, united above by the persistent lid; veil mitriform; leaf-cells punctiform.

\* *Leaves nerveless.*

1. *A. alpina*, Dill.; stem elongated; branches fastigate; leaves crowded, erecto-patent, even, obovate, acuminate, contracted in the middle, mostly entire above, toothed below; inner perichæatial leaves convolute.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 1278.*; (Plate 2, fig. 6.)

On alpine rocks. Bearing fruit in early summer.

Monoicous; bearing the antheridia on slender innovations; forming dense tufts 2 or 3 inches high. Leaves often contracted below so as to be somewhat lingulate or panduriform, even, reddish or purplish, abruptly pointed; leaf-cells punctiform above, elongated and vermiform below; walls very thick; sporangium apophysate when young; valves reaching to the apophysis; perichæatial leaves large; the inner ones convolute.

2. *A. petrophila*, Ehr.; stem short; leaves patent or subsecund, ovate, acuminate, but rather obtuse, papillose behind; perichæatial leaves large, convolute.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 1277.*; (*Moug. & Nest. n. 115.*)

On subalpine rocks. Bearing fruit in early summer.

Extremely variable in habit, the size and direction of the leaves, etc., but always distinguishable from the last by its rufous, opaque, papillose leaves, which are frequently more or less secund, even in plants where many are spreading.

Found in all parts of the world.

\*\* *Leaves nerved.*

3. **A. Rothii**, *Web. & Mohr*; monoicous; stems short, fastigiate; leaves spreading, curved or falcate at the tip, ovate below, subulate above, even, opaque; nerve reaching to the apex; perichæatial leaves rather short, elliptic, convolute.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 2162.*; (Plate 2, fig. 7); *Moug. & Nest. n.116.*

On alpine and subalpine rocks. Bearing fruit in early summer.

Varying like the last in the direction of the leaves, which exhibit different shades of brown, sometimes so dark as to be almost black; nerve predominant towards the apex; leaf-cells of the disk larger than those towards the margin.

Schimper considers this to be the true *Jungermannia rupestris* of Linnæus; others think that it is *A. petrophila*.

4. **A. nivalis**, *Hook.*; dioicous; stems elongated, fastigiate, falcate above; leaves falcato-secund, papillose, opaque; leaf-cells quadrate; perichæatial leaves resembling the cauline; veil very small.—*Hook. & Wils. t. viii.*; *Eng. Bot. t. 2334.*

On high alpine rocks. Scotland and Wales. Bearing fruit, but rarely, in summer.

The dioicous inflorescence, the conformity of the perichæatial leaves to those of the stem, the laxer reticulations, which are quadrate to the very base, and other points abundantly distinguish this from the last. There are frequently more than four valves to the sporangium.

## GLOSSARY.

*Acicular*, shaped like a bodkin.

*Acrocarpous*, bearing fruit at the tip of the stem or branches.

*Annulus*, a little ring, which is often elastic, at the rim of the mouth of the sporangium.

*Antheridia*, oblong or globular cellular bodies, containing the spermatozoids.

*Apophysis*, a swelling of greater or less size at the base of the sporangium or tip of the fruitstalk, sometimes belonging more or less to both.

*Apophysate*, furnished with an apophysis.

*Appendiculate*, fringed with little fragmentary bodies.

*Archegonium*, the young flask-shaped female fruit, in the cavity of which the embryonic cell is generated.

*Areolate*, divided into little areas, a term applied to the cellular tissue of the leaves.

*Bifarious*, two-ranked, a term applied to the leaves.

*Bigeminate*, a term applied to the teeth of the peristome when combined in two pairs.

*Calyptra*, the membranous cap of

the sporangium, derived from the wall of the archegonium, which splits below and is carried up by the swollen sporangium as the fruitstalk elongates.

*Cancelled*, like lattice-work.

*Capsule*, a name usually applied to the sporangium, but rejected here because it is manifestly incorrect.

*Cernuous*, drooping: spoken of the sporangium.

*Chlorophyllous*, spoken of the leaf-cells when they manifestly contain a green grumous mass, or little pellets of chlorophyll.

*Cilia*, processes which sometimes alternate with the teeth of the inner peristome.

*Cladocarpous*, used when the sporangia are produced on extremely short branchlets.

*Columella*, the little central column which occurs in the centre of most sporangia.

*Commissure*, the point of junction of two cells, or of the lid and mouth of the sporangium.

*Cotyledonoids*, a term applied to the germinating threads of mosses, from a notion that they are analo-

- gous to the cotyledons of Phænogams.
- Cucullate*, hoodshaped, a term applied to the veil or calyptra when split on one side.
- Dimidiate*, the same with cucullate.
- Distichous*, two-ranked, applied to the leaves.
- Exserted*, applied when the fruit-stalk projects beyond the perichætium.
- Falcate*, sickle-shaped.
- Follicle*, a little bladder on the leaves, as in *Pottia cavifolia*.
- Geniculate*, bent suddenly.
- Innovations*, accessory branches produced generally after the fruit is perfect.
- Lid*, the terminal portion of the sporangium, which usually separates by a circular horizontal fissure.
- Ligulate*, strap-shaped.
- Lingulate*, tongue-shaped.
- Mitriiform*, applied to the veil, when not split on one side, or fissured more or less symmetrically.
- Ocrea*, a little sheath sometimes investing the base of the fruitstalk, distinct from the vaginula.
- Operculum*, the same with the lid.
- Papillose*, covered with minute papillæ, as the leaves of several mosses.
- Paraphylla*, variously shaped foliaceous or filamentous bodies produced near the leaves, but not at definite points like stipules.
- Paraphyses*, threads accompanying the archegonia or antheridia.
- Perichætium*, the leaves immediately surrounding the base of the fruit-stalk.
- Perigamium*, the portion of the fertile reduced branchlets which contains the archegonia.
- Perigonium*, the male inflorescence.
- Perigynium*, the leaves encircling the fertile bud.
- Peristome*, the processes which are produced within the mouth of the sporangium, which by their hygrometric nature modify the dispersion of the spores.
- Pleurocarpous*, used when the fruit is lateral, and produced on rudimentary branchlets.
- Polygamous*, having the male and female inflorescence variously disposed in the same species.
- Proembryo*, the same with cotyledonoids.
- Prothallus*, the same with Cotyledonoids.
- Protonemata*, the same with Cotyledonoids.
- Pulvinate*, forming cushion-like masses.
- Reticulation*, the same with areolation.
- Ring*, the same with annulus.
- Rostrate*, spoken of the lid when elongated; when less elongated it is said to be rostellate.
- Rosulate*, leaves disposed like the petals of a rose.
- Scalariform*, ladder-like.
- Secund*, leaning to one side.
- Seta*, the same with fruitstalk.
- Setaceous*, bristle-shaped.
- Spathulate*, narrow below, broader above; spoon-shaped.
- Spermatozoids*, the active bodies, produced in the antheridia, by which the embryonic cell of the archegon is impregnated.



*Sporangium*, the perfect female fruit, usually called capsule.

*Spores*, the reproductive bodies, which are produced after impregnation.

*Spore-sac*, that part of the sporangium which contains the spores.

*Squarrose*, spreading in every direction and more or less bent backwards, spoken of the leaves.

*Symmetrical*, applied to the sporangium when quite regular.

*Syncladous*, used when branchlets

grow in tufts from the same point.

*Synœcious*, used when the male and female fruit are united in the same head.

*Systylous*, used when the lid adheres to the columella.

*Theca*, the same with sporangium.

*Tristichous*, three-ranked.

*Tympanoid*, resembling the head of a drum.

*Unsymmetrical*, applied to irregular sporangia.

*Veil*, the same with calyptra.

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PLATE I.

Fig. 1. Prothallus of *Sphagnum cuspidatum* (after Hofmeister).

Fig. 2. Archegonium of *Phascum*, showing the embryonic cell with its nucleus just after impregnation, magnified (after Hofmeister).

Fig. 3. Antheridium and paraphyses of *Mnium punctatum*, magnified. The antheridium is ejecting the spermatozoids.

Fig. 4. Antheridium of *Sphagnum* (after Hofmeister).

Fig. 5. Perforated leaf-cells of *Sphagnum*, containing a spiral thread, and surrounded by narrow chlorophyllous cells, magnified.

Fig. 6. Perforated cells of *Leucobryum glaucum*, enclosing chlorophyllous cells.

Fig. 7. Section of upper part of sporangium of *Phascum cuspidatum*, magnified (after Lantzius-Beninga).

*c.* columella.

*s.* spore-sac.

*a.* walls of spore-sac.

*i.* intermediate space.

*m.* inner wall of intermediate space.

*k.* outer wall of intermediate space.

*w.* wall of sporangium.

Fig. 8. Section of upper part of sporangium of *Bartramia fontana*, magnified (after Lantzius-Beninga).

*c.* columella.

*s.* spore-sac.

*a.* outer wall of spore-sac.

*i.* intermediate space, traversed with threads.

*m.* inner wall of intermediate space.

*k.* outer wall of intermediate space.

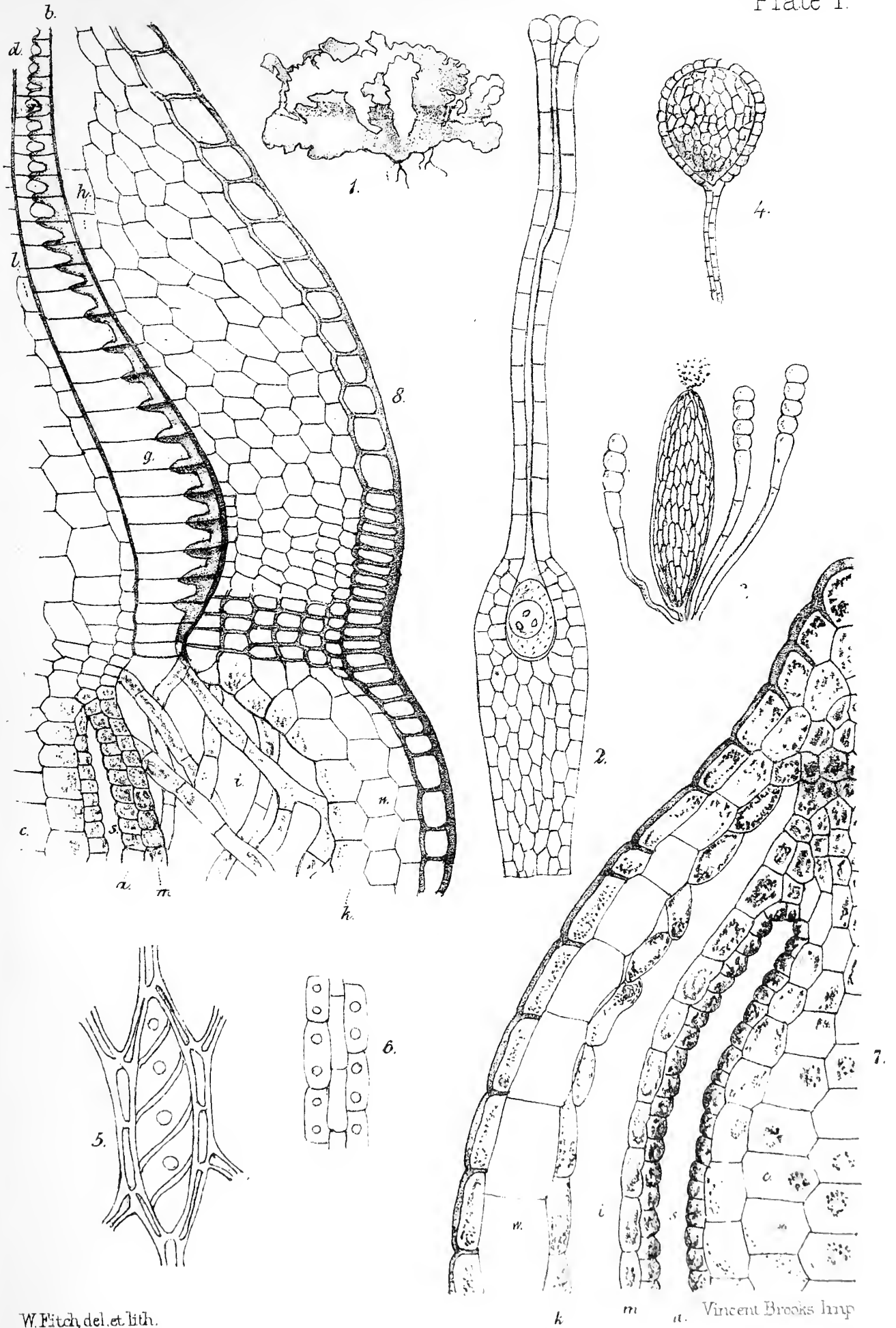
*l.* row of cells continued from *m.*

*g.* row of cells continued from top of intermediate space.

*d.* inner peristome, formed from the thickening of the outer wall of the cells in *l* and the inner wall of the cells in *g*.

*h.* row of cells continued from outer wall of intermediate space.

*b.* outer peristome, formed by the thickening of the outer wall of the cells in *g* and of the inner wall of the cells in *h*.



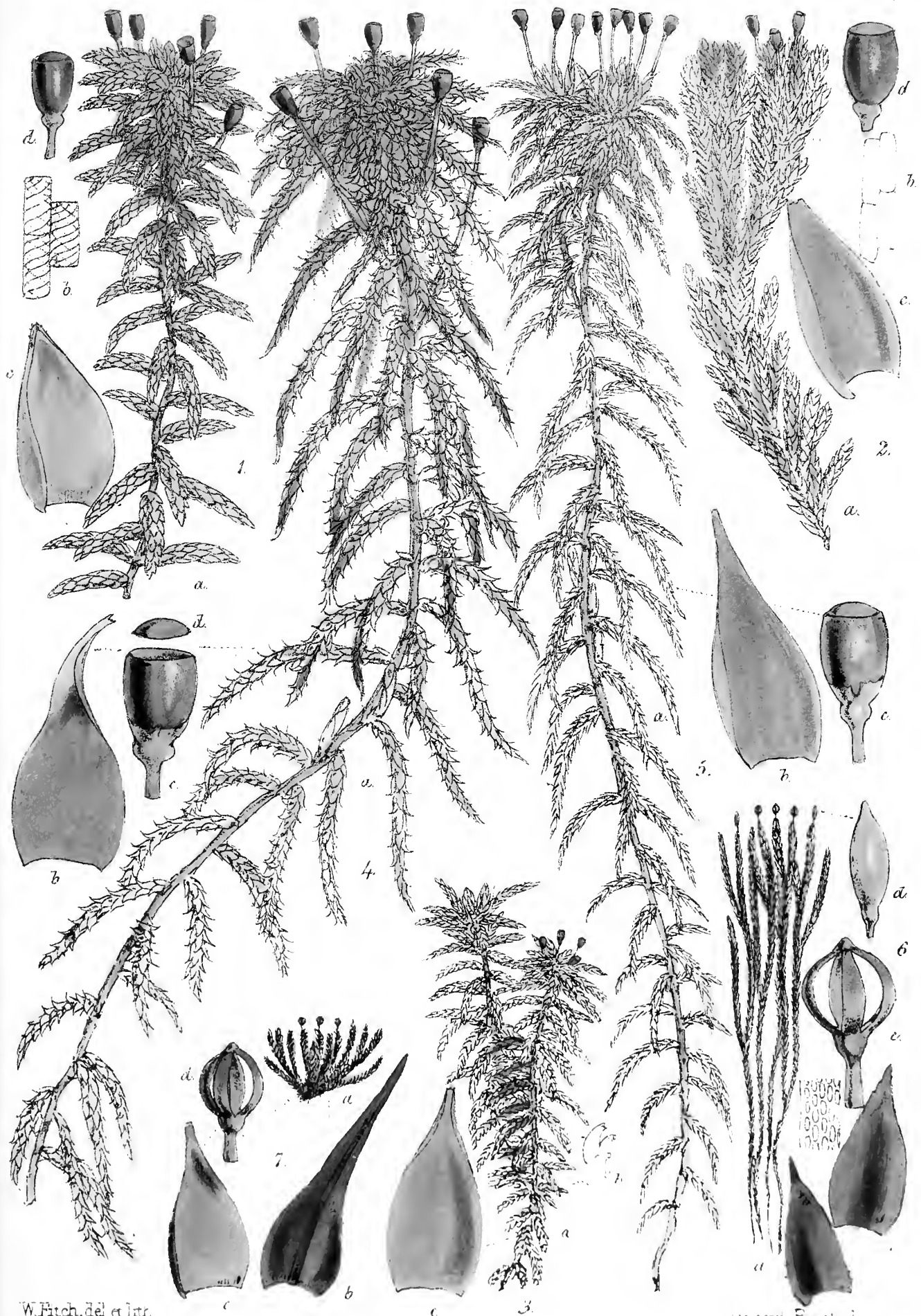






## PLATE II.

1. *Sphagnum cymbifolium*.
  - a.* plant, nat. size.
  - b.* cells from stem, magnified.
  - c.* leaf, magnified.
  - d.* sporangium.
2. *S. compactum*.
  - a.* plant, nat. size.
  - b.* cells from stem, magnified.
  - c.* leaf, magnified.
  - d.* sporangium.
3. *S. molluscum*.
  - a.* plant, nat. size.
  - b.* cells from stem, magnified.
  - c.* leaf, magnified.
4. *S. acutifolium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with remains of veil, magnified.
  - d.* lid, magnified.
5. *S. squarrosum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with remains of veil, magnified.
6. *Andreæa alpina*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* portion of leaves, magnified.
  - d.* young sporangium, magnified.
  - e.* sporangium ruptured, magnified.
7. *A. rupestris*.
  - a.* plant, nat. size.
  - b, c.* leaves, magnified.
  - d.* sporangium, magnified.



W. Fitch, del et lit.

Ericks imp.





PLATE III.

1. *Fontinalis squamosa*.
  - a.* leaf, magnified.
  - b.* sporangium with perichætium, magnified.
  - c.* portion of outer and inner peristome, magnified.
2. *F. antipyretica*.
  - a.* leaf, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium with perichætium, magnified.
  - d.* veil, magnified.
  - e.* sporangium with peristome, magnified.
3. *Cryphæa heteromalla*.
  - a.* leaf, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium with perichætium, magnified.
  - d.* veil, magnified.
4. *Daltonia splachnoides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
  - d.* part of peristome, magnified.
5. *Hookeria lucens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
  - d.* part of peristome, magnified.
6. *H. læte-virens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

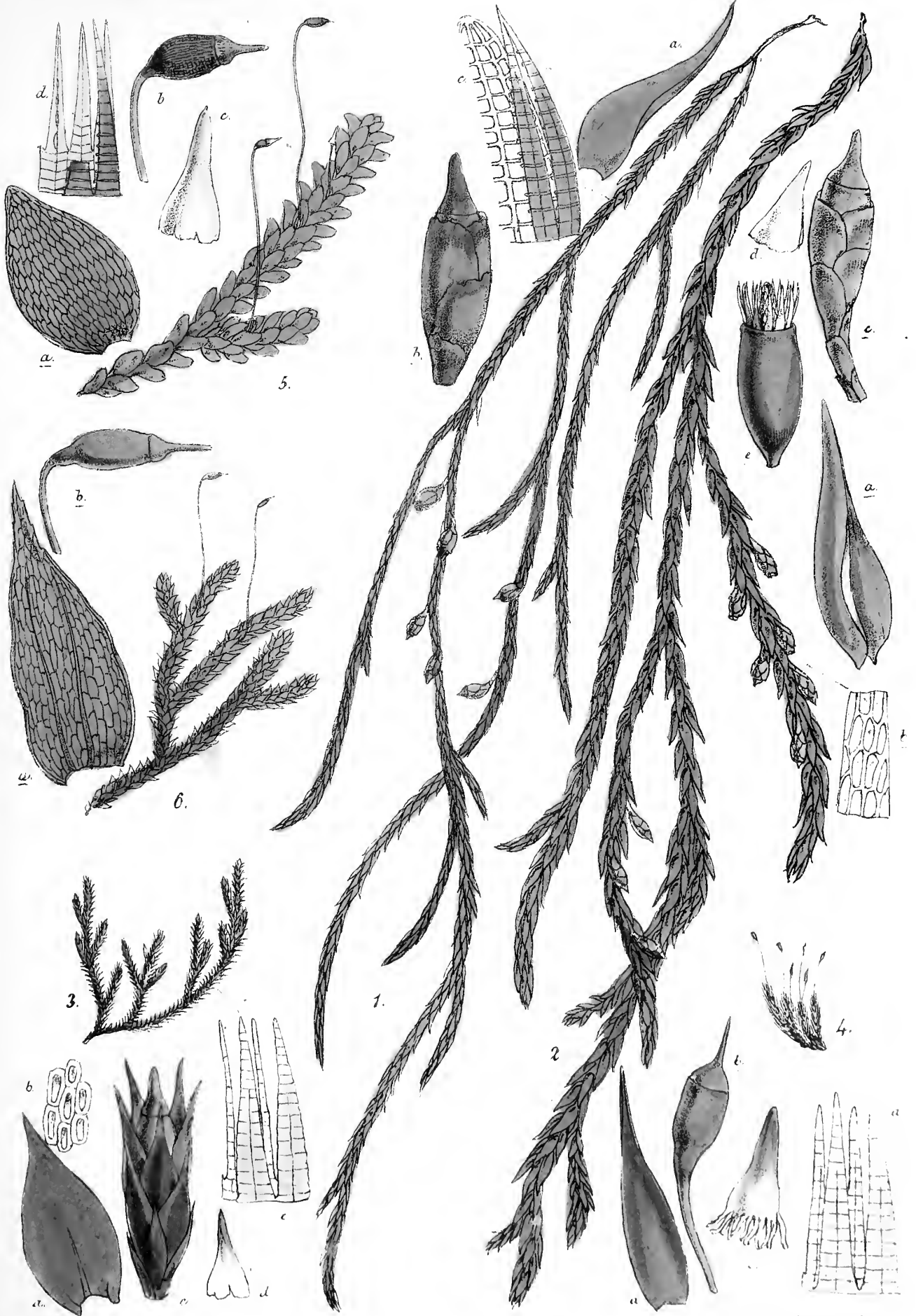








PLATE IV.

1. *Neckera complanata*.
  - a.* leaves, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium, magnified.
  - d.* veil, magnified.
2. *N. crispa*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
3. *N. pumila*.
  - a.* leaf magnified.
  - b.* sporangium magnified.
  - c.* part of peristome, magnified, seen from within.
4. *N. pennata*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified, with perichætium.
5. *Homalia trichomanoides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
6. *Hypnum nitens*.
  - a.* rootlets, magnified.
  - b.* tip of one more highly magnified.
  - c.* leaves, magnified.
  - d.* sporangium, magnified.



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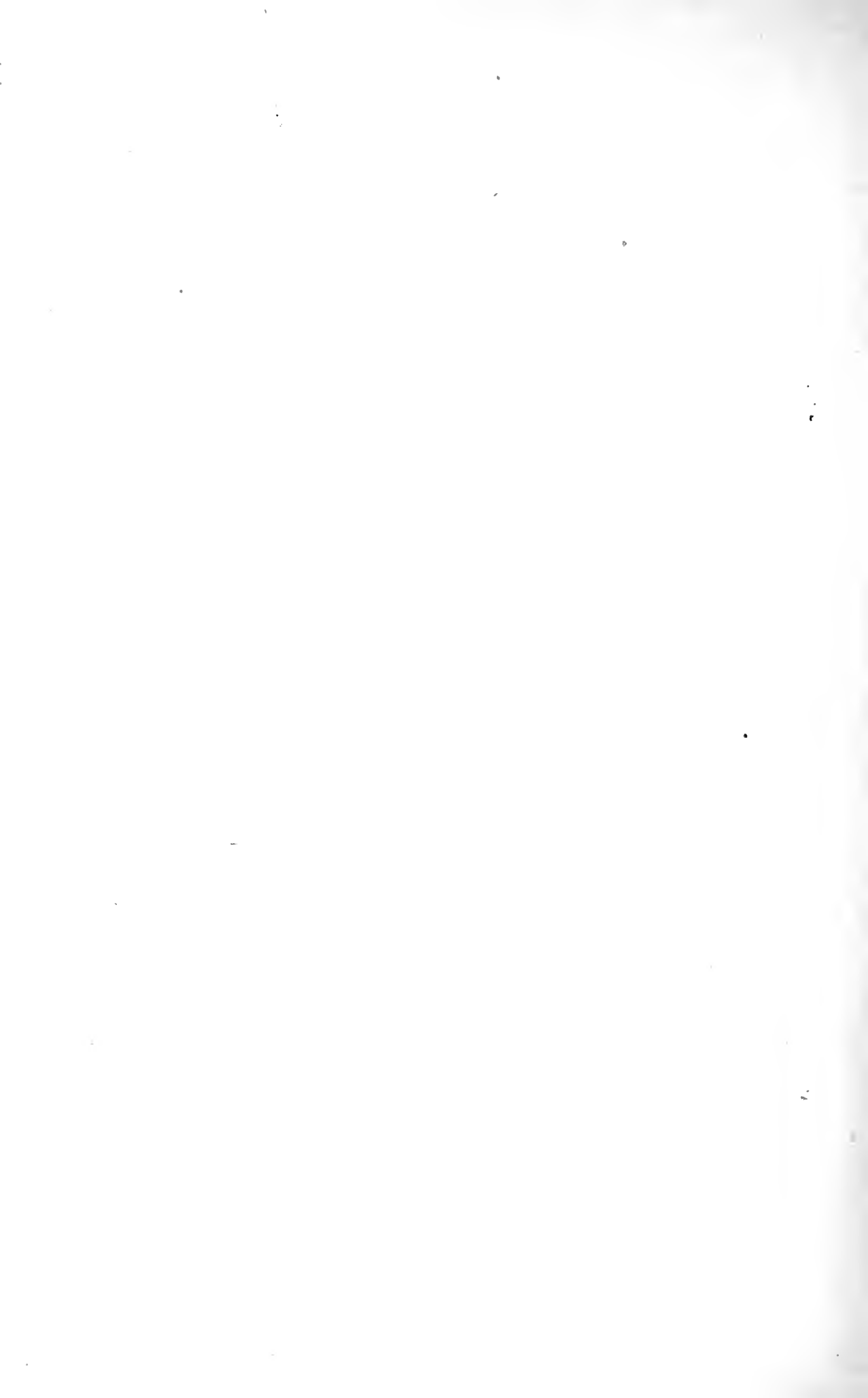




PLATE V.

1. *Hypnum albicans*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* lid, magnified.
2. *H. lutescens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. plumosum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
4. *H. velutinum*.
  - a.* leaf, magnified.
  - b.* sporangium, with peristome, magnified.
  - c.* sporangium, with lid, magnified.
5. *H. rutabulum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* part of peristome, magnified.
  - d.* ring, magnified.
6. *H. rivulare*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.









PLATE VI.

1. *Hypnum ruscifolium*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. murale*.
  - a.* leaf, magnified.
  - b.* young veil, magnified.
  - c.* sporangium, magnified.
3. *H. riparium*.
  - a.* leaf magnified.
  - b.* sporangium, magnified.
  - c.* male inflorescence, magnified.
  - d.* antheridium, magnified.
4. *H. polygamum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *H. chrysophyllum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
6. *H. stellatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.

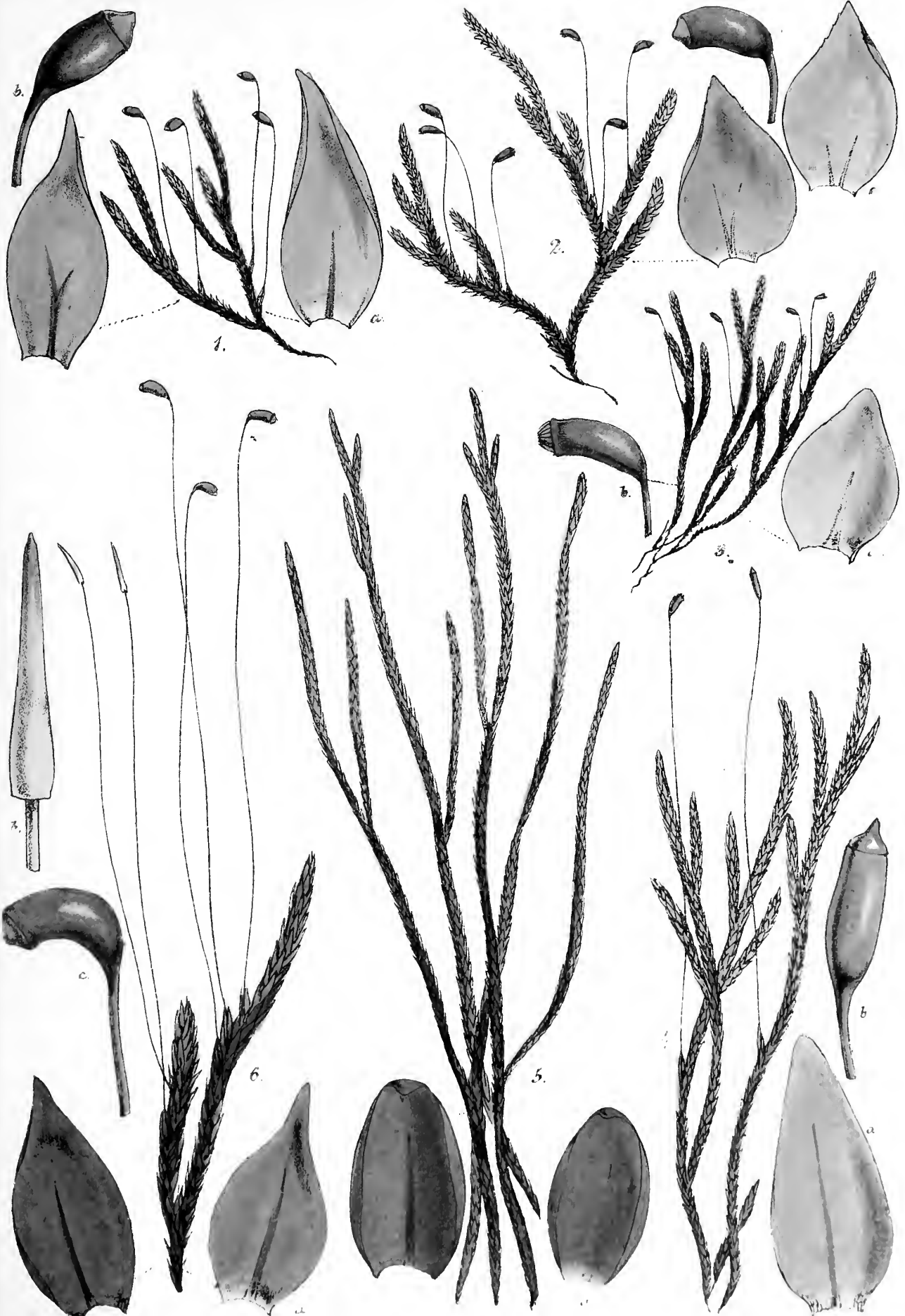






PLATE VII.

1. Hypnum palustre.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
2. H. molle.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
3. H. arcticum.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
4. H. stramineum.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. H. trifarium.
  - a.* leaves, magnified.
6. H. cordifolium.
  - a.* leaves, magnified.
  - b.* young veil, magnified.
  - c.* sporangium, magnified.



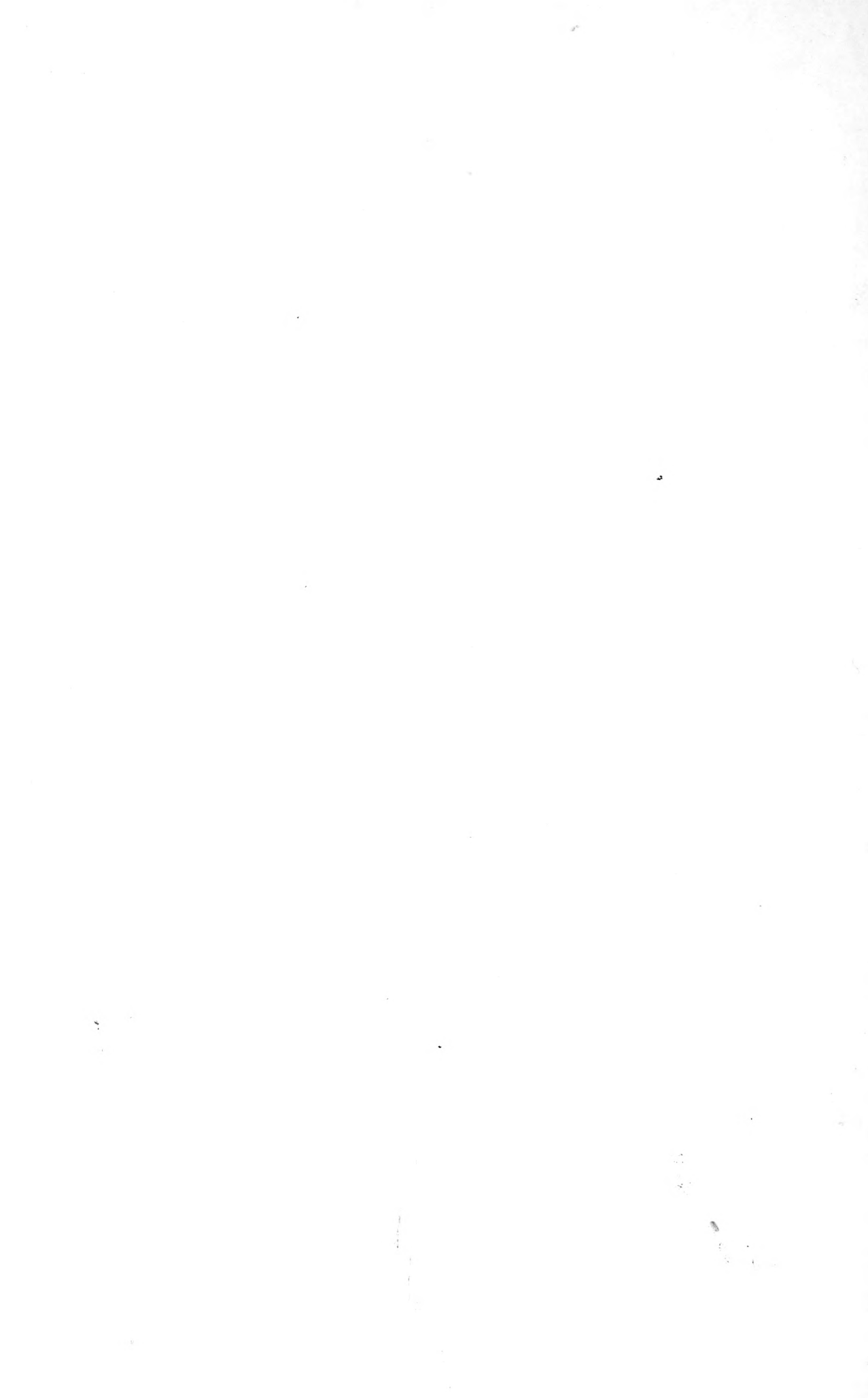






PLATE VIII.

1. *Hypnum cuspidatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. Schreberi*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
3. *H. purum*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
4. *Thuidium tamariscinum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *Hypnum Blandovii*.
  - a.* leaf, magnified.
  - b.* leaf, seen from behind, with down-like paraphylla.
  - c.* sporangium, magnified.

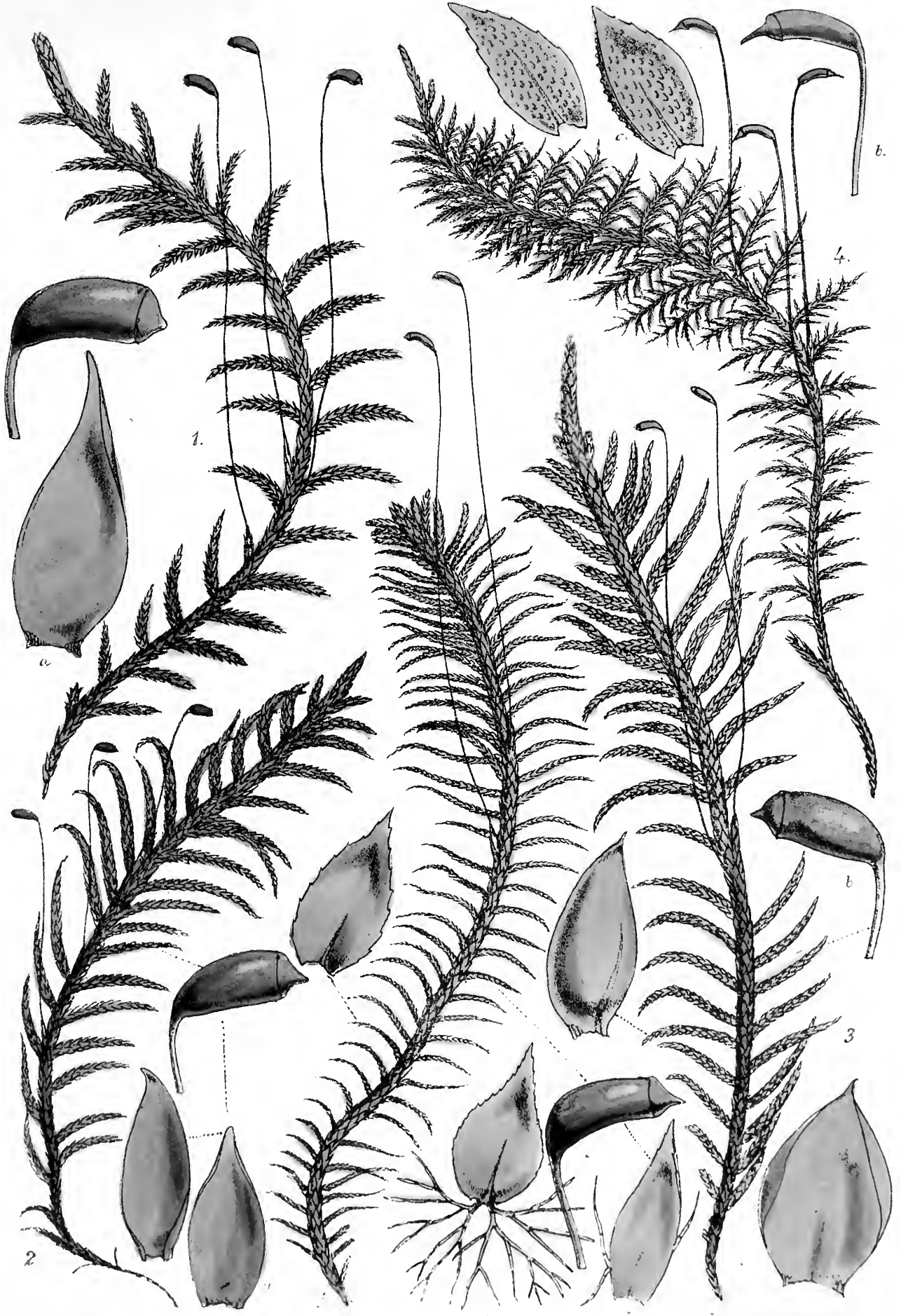






PLATE IX.

1. *Hypnum splendens*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. brevirostre*.
  - a.* leaves, from before and behind, magnified.
  - b.* sporangium, magnified.
3. *H. triquetrum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. loreum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *H. flagellare*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.







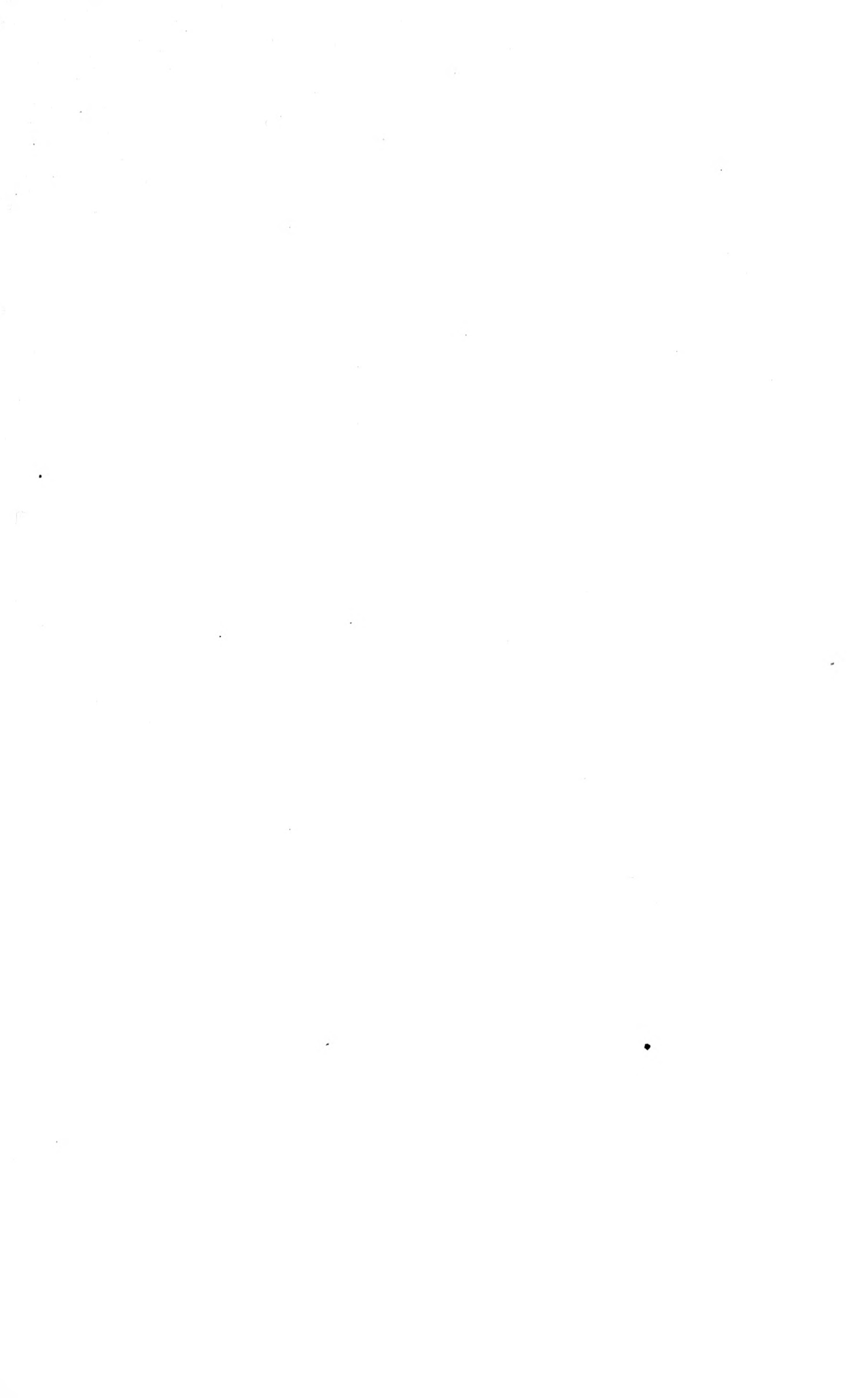


PLATE X.

1. *Hypnum squarrosum* (a procumbent form).
  - a.* leaf from behind, magnified.
  - b.* sporangium, magnified.
2. *H. aduncum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
3. *H. fluitans*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. revolvens*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
5. *H. commutatum*.
  - a.* leaf from behind, magnified.
  - b.* sporangium, magnified.
6. *H. filicinum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.







PLATE XI.

1. *Hypnum uncinatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
2. *H. Crista-castrensis*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. molluscum* (different from the usual habit).
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
4. *H. cupressiforme*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *H. scorpioides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* male inflorescence, magnified.
6. *H. demissum*.
  - a.* leaves from before and behind, magnified.
  - b.* sporangium, magnified.









PLATE XII.

1. *Hypnum pulchellum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.
2. *H. denticulatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
3. *H. elegans*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
4. *H. undulatum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
5. *Pylaisia polyantha*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
6. *Homalothecium sericeum*.
  - a.* leaves, magnified.
  - b.* sporangium, magnified.







PLATE XIII.

1. *Thamnum alopecurum*.
  - a.* leaf, magnified.
  - b.* veil, magnified.
  - c.* sporangium, magnified.
2. *Climacium dendroides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
3. *Leucodon sciuroides*.
  - a.* leaves, magnified.
  - b.* leaf-cells, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome with ring, magnified.
4. *Antitrichia curtispindula*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
  - d.* portion of inner peristome, more highly magnified.
5. *Leptodon Smithii*.
  - a.* leaves, magnified.
  - b.* veil, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
6. *Anomodon viticulosum*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome seen from within, magnified.



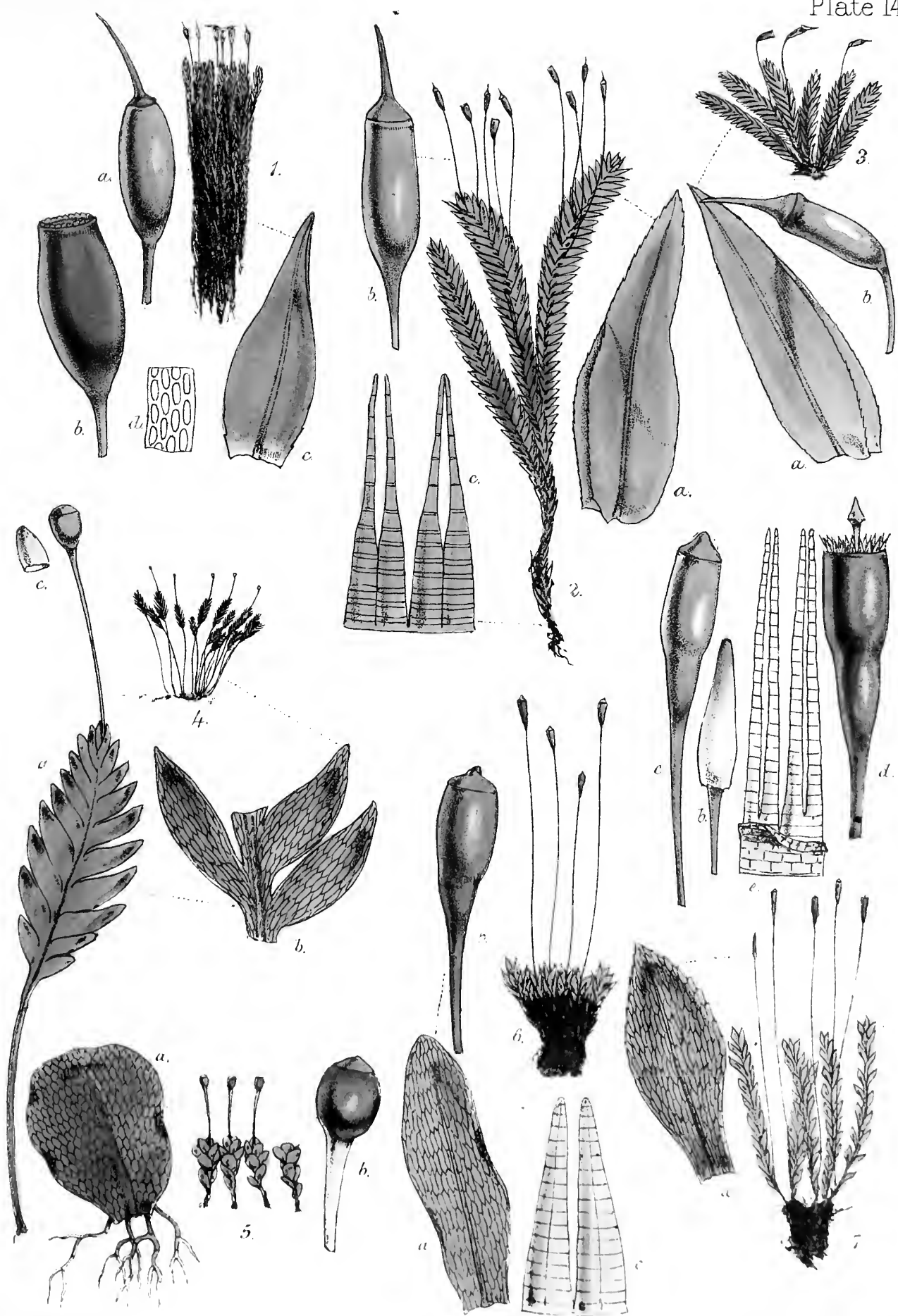






PLATE XIV.

1. *Anœctangium compactum*.
  - a.* sporangium, magnified.
  - b.* sporangium after lid has fallen.
  - c.* leaf, magnified.
  - d.* leaf-cells, magnified.
2. *Fissidens adiantoides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
3. *F. taxoides*. *Taxoides*
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
4. *Schistostega osmundacea*.
  - a.* plant, magnified.
  - b.* part more highly magnified.
  - c.* lid, magnified.
5. *Ædipodium Griffithii*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
6. *Dissodon splachnoides*.
  - a.* leaf, magnified.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
7. *Tayloria serrata*.
  - a.* leaf, magnified.
  - b.* young veil, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium, when dry.
  - e.* portion of peristome, magnified.



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PLATE XV.

1. *Tetraplodon angustatus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium without lid, magnified.
2. *T. mnioides*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, magnified.
  - d.* sporangium without lid.
  - e.* portion of peristome, magnified.
3. *Splachnum sphæricum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, magnified.
  - d.* sporangium without lid.
4. *S. ampullaceum*.
  - a.* plant, male and female, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
5. *S. vasculosum*.
  - a.* plant, male and female, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium with lid, mag.
  - d.* sporangium without lid.
6. *Discelium nudum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* peristome with ring and spores, mag.
7. *Catoscopium nigratum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
8. *Conostomum boreale*.
  - a.* plant, nat. size.
  - b.* sporangium, magnified.
  - c.* portion of peristome, magnified.
  - d.* portion of one of the teeth, mag.
  - e.* leaf, magnified.

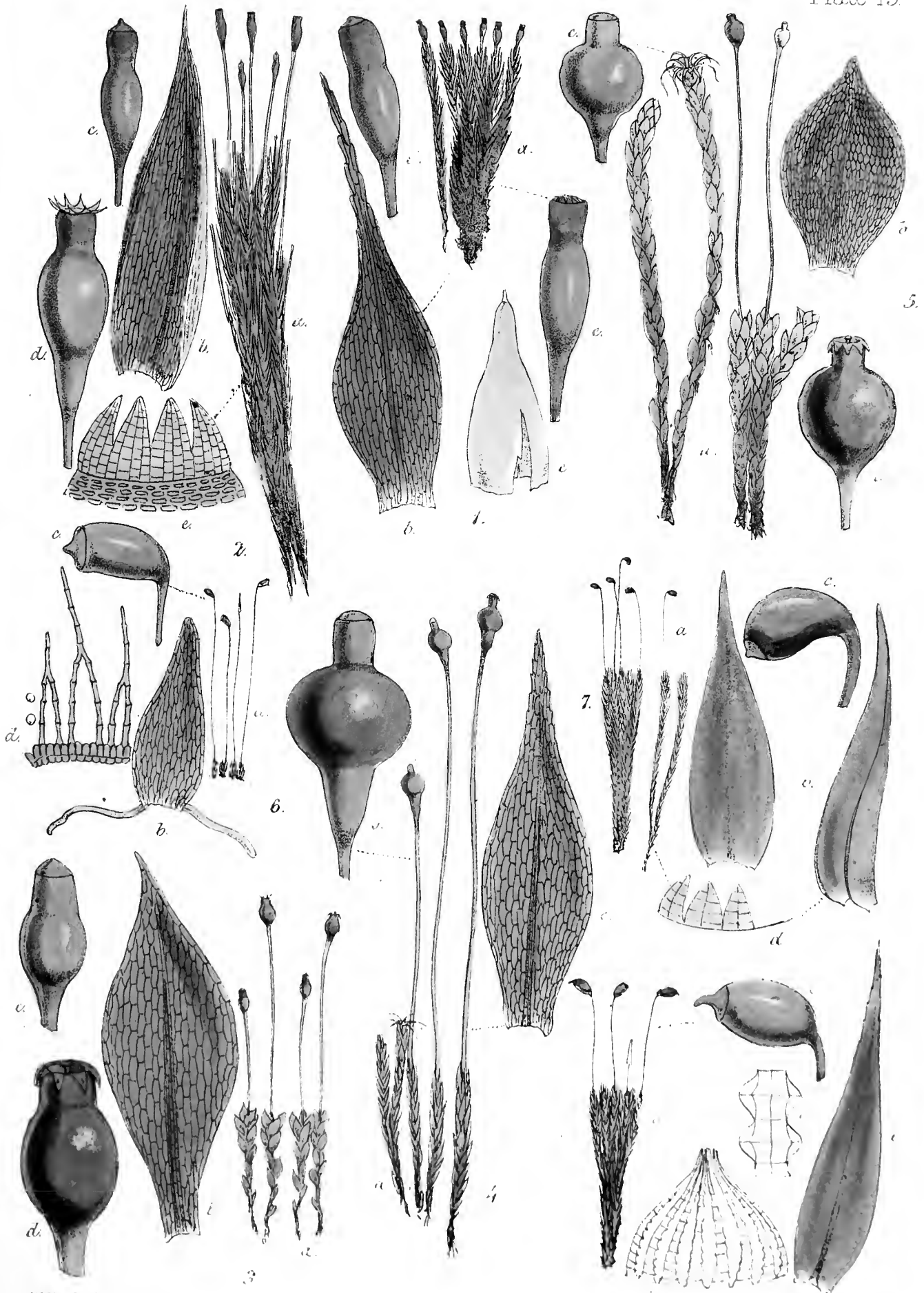








PLATE XVI.

1. *Bartramia ithyphylla*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *B. pomiformis*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells and margin, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
3. *B. Oederi*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *B. calcarea*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of inner peristome of *B. fontana*, magnified.
5. *Entosthodon Templetoni*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
6. *Funaria hygrometrica*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of outer peristome, magnified.
  - e.* portion of inner peristome.
7. *Meesia uliginosa*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* spore, magnified.

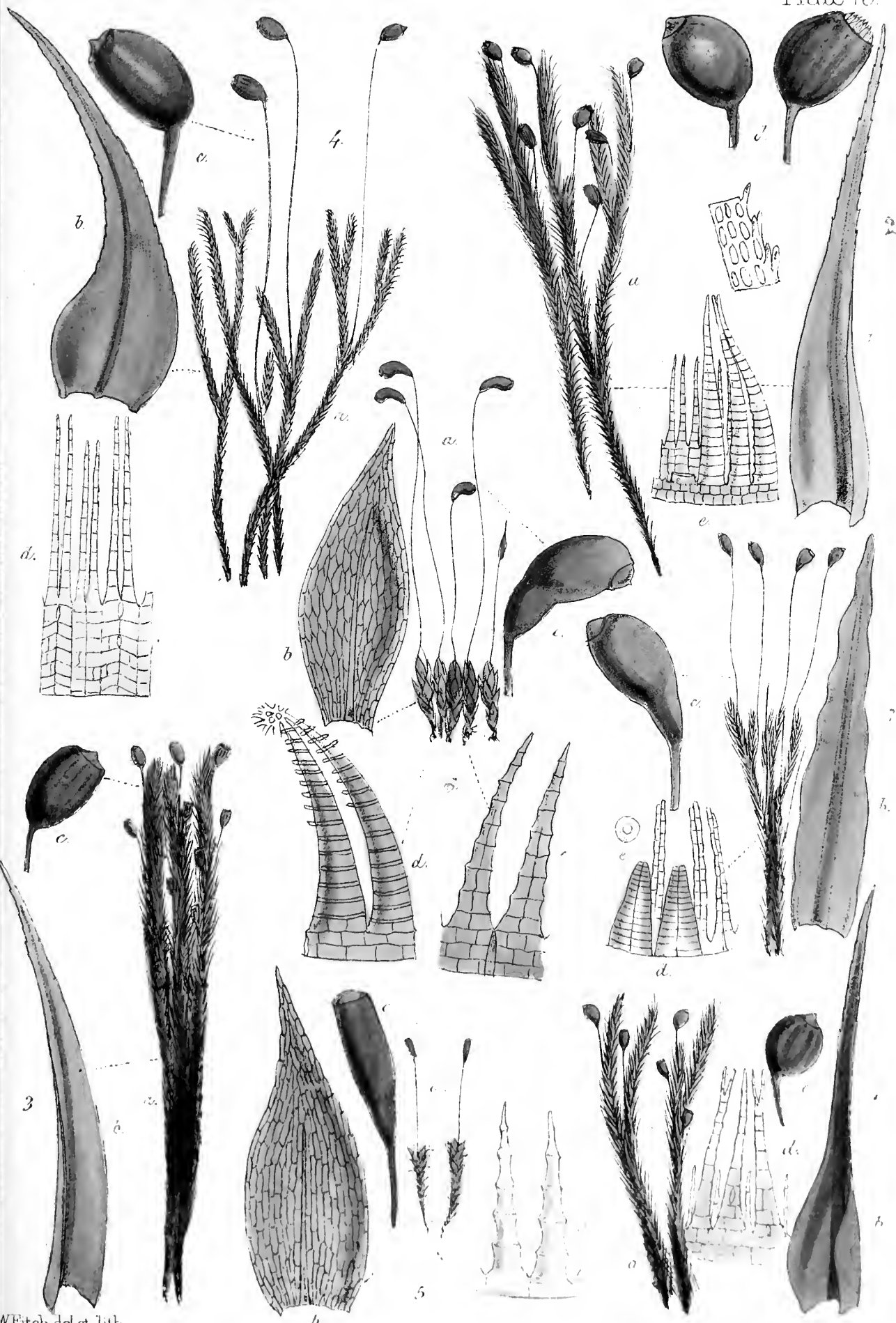






PLATE XVII.

1. *Cinclidium stygium*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *Mnium affine*.
  - a.* female plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* male plant, nat. size.
3. *M. cuspidatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *M. undulatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
5. *M. rostratum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
6. *M. punctatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
7. *Amblyodon dealbatus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* portion of inner peristome, more highly magnified.



W Fitch, del. et. lith.

Essent. mosses. Lith.

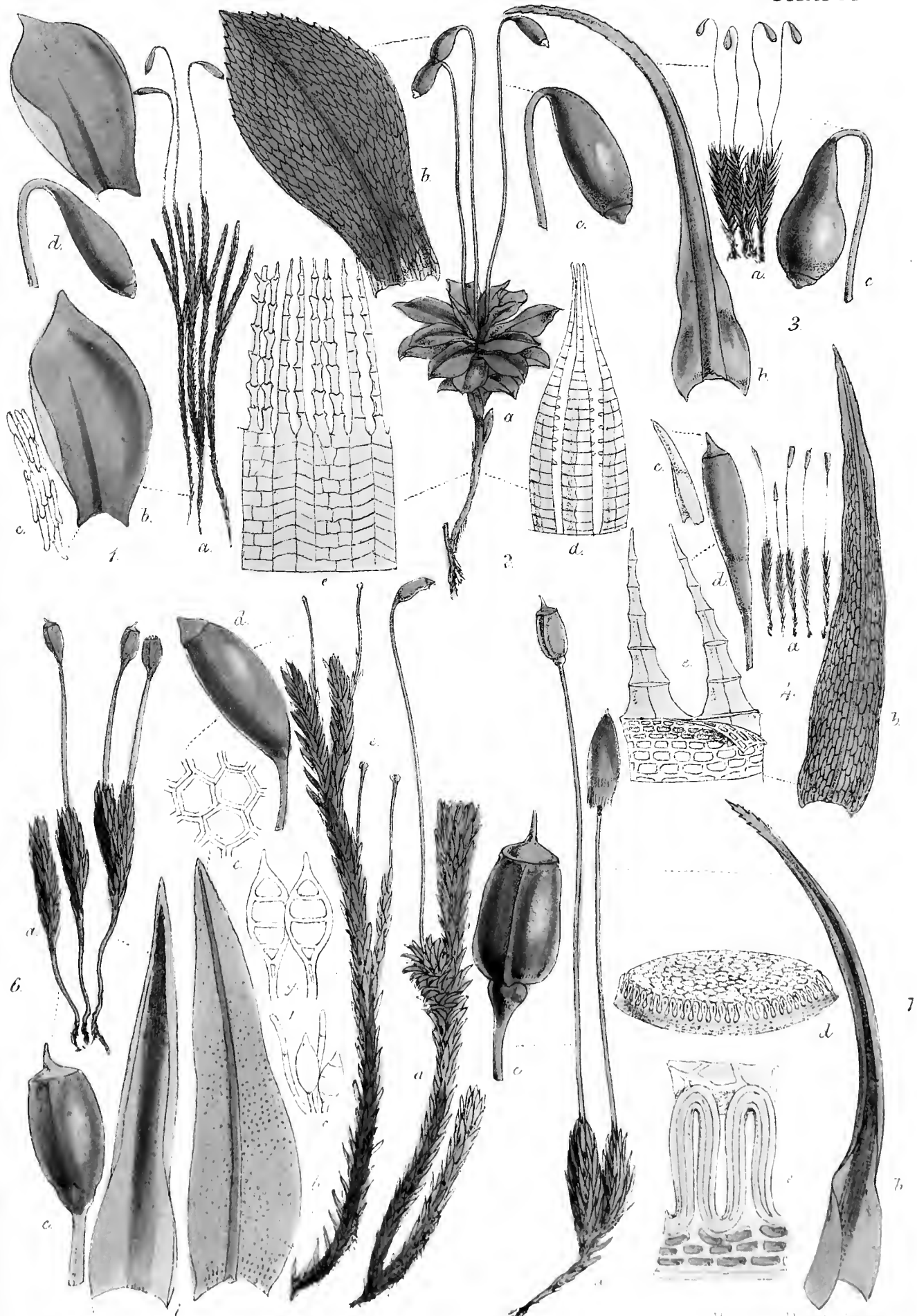






PLATE XVIII.

1. *Zieria julacea*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells, magnified.
  - d.* sporangium, magnified.
2. *Bryum roseum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of outer peristome, magnified.
  - e.* portion of inner peristome, magnified.
3. *Leptobryum pyriforme*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *Orthodontium gracile*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of outer peristome, magnified.
5. *Aulacomnion palustre*.
  - a.* female plant, nat. size.
  - b.* leaf, magnified.
  - c.* leaf-cells, magnified.
  - d.* sporangium, magnified.
  - e.* gemmiferous plant, nat. size.
  - f.* gemmæ, magnified.
  - g.* gemmæ, more magnified.
6. *Polytrichum septentrionale*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
7. *P. juniperinum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* peristome, magnified.
  - e.* portion highly magnified.



W. Fitch, del. et lith.

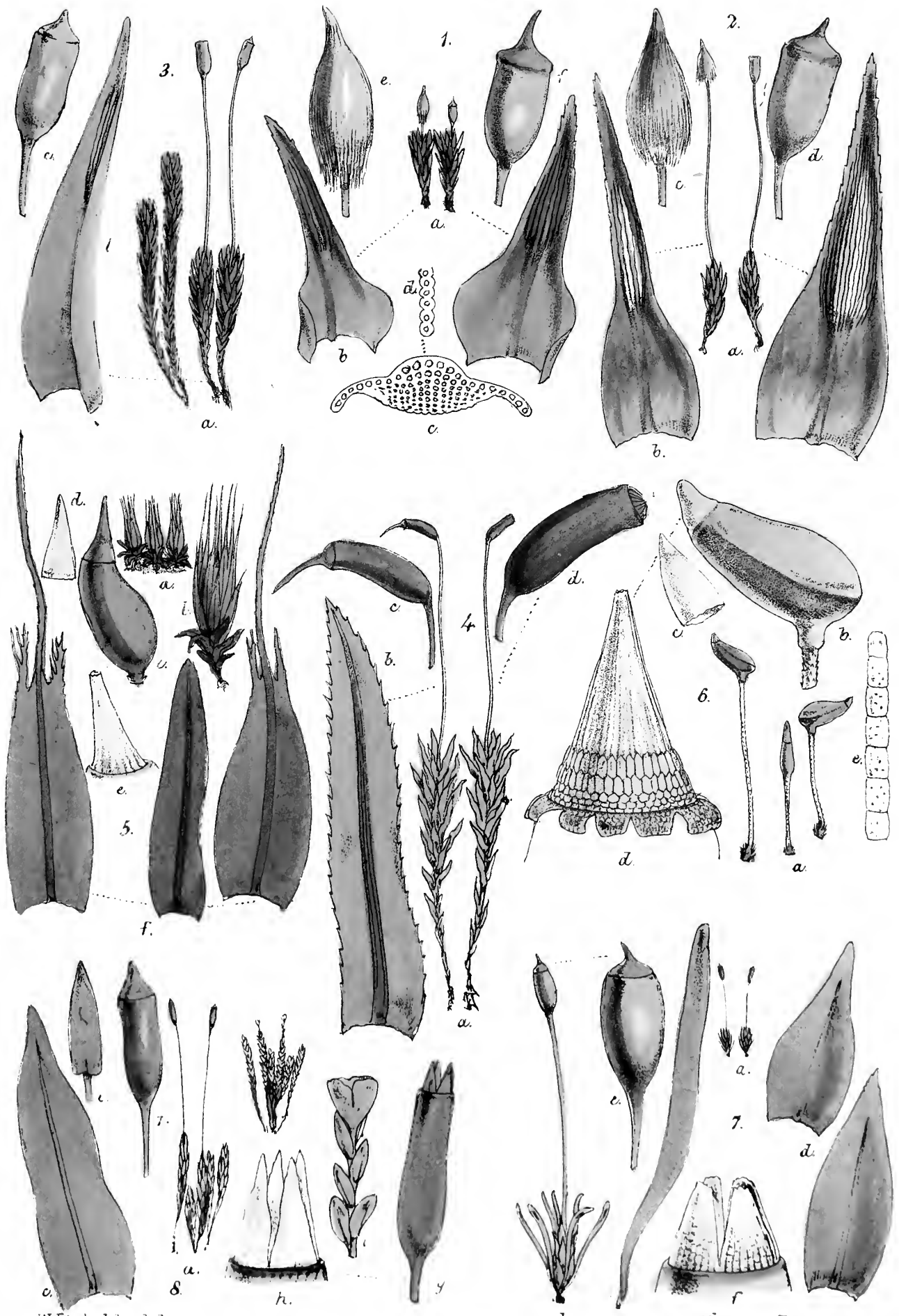
Vernonia, Brooks, 184.





PLATE XIX.

1. *Pogonatum nanum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* section of leaves, mag.
  - d.* section of one of the lamellæ, mag.
  - e.* young veil, magnified.
  - f.* sporangium, magnified.
2. *P. aloides*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* young veil, magnified.
  - d.* sporangium, magnified.
3. *P. hereynicum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
4. *Atrichum undulatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium, without lid.
5. *Diphyscium foliosum*.
  - a.* plants, nat. size.
  - b.* plants, magnified.
  - c.* sporangium, mag.
  - d.* veil, magnified.
  - e.* peristome, magnified.
  - f.* leaf, mag., with two perichæatial leaves.
6. *Buxbaumia aphylla*.
  - a.* plants, nat. size.
  - b.* sporangium, magnified.
  - c.* veil, magnified.
  - d.* peristome, magnified.
  - e.* a portion of inner peristome, magnified.
7. *Tetrodontium Brownianum*.
  - a.* plant, nat. size.
  - b.* plant, magnified.
  - c.* leaf, magnified.
  - d.* perichæatial leaves, magnified.
  - e.* sporangium, magnified.
  - f.* peristome, magnified.
8. *Tetraphis pellucida*.
  - a.* plant, nat. size.
  - b.* gemmiferous plant, nat. size.
  - c.* leaf, magnified.
  - d.* gemmiferous apex, magnified.
  - e.* young veil, magnified.
  - f.* sporangium with lid, magnified.
  - g.* sporangium without lid.
  - h.* peristome, magnified (the transverse lines are too strongly marked).



W. Fitch, del. et lith.

Vincent Brooks Imp







PLATE XX.

1. *Zygodon conoideus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
2. *Z. viridissimus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* sporangium, after lid has fallen.
3. *Z. lapponicus*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* sporangium, after lid has fallen.
4. *Orthotrichum cupulatum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome magnified.
5. *O. anomalum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium, without lid.
6. *O. diaphanum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
7. *O. pulchellum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* young veil, magnified.
  - d.* sporangium with lid, magnified.
  - e.* sporangium without lid, magnified.
8. *O. leiocarpum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified.
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.

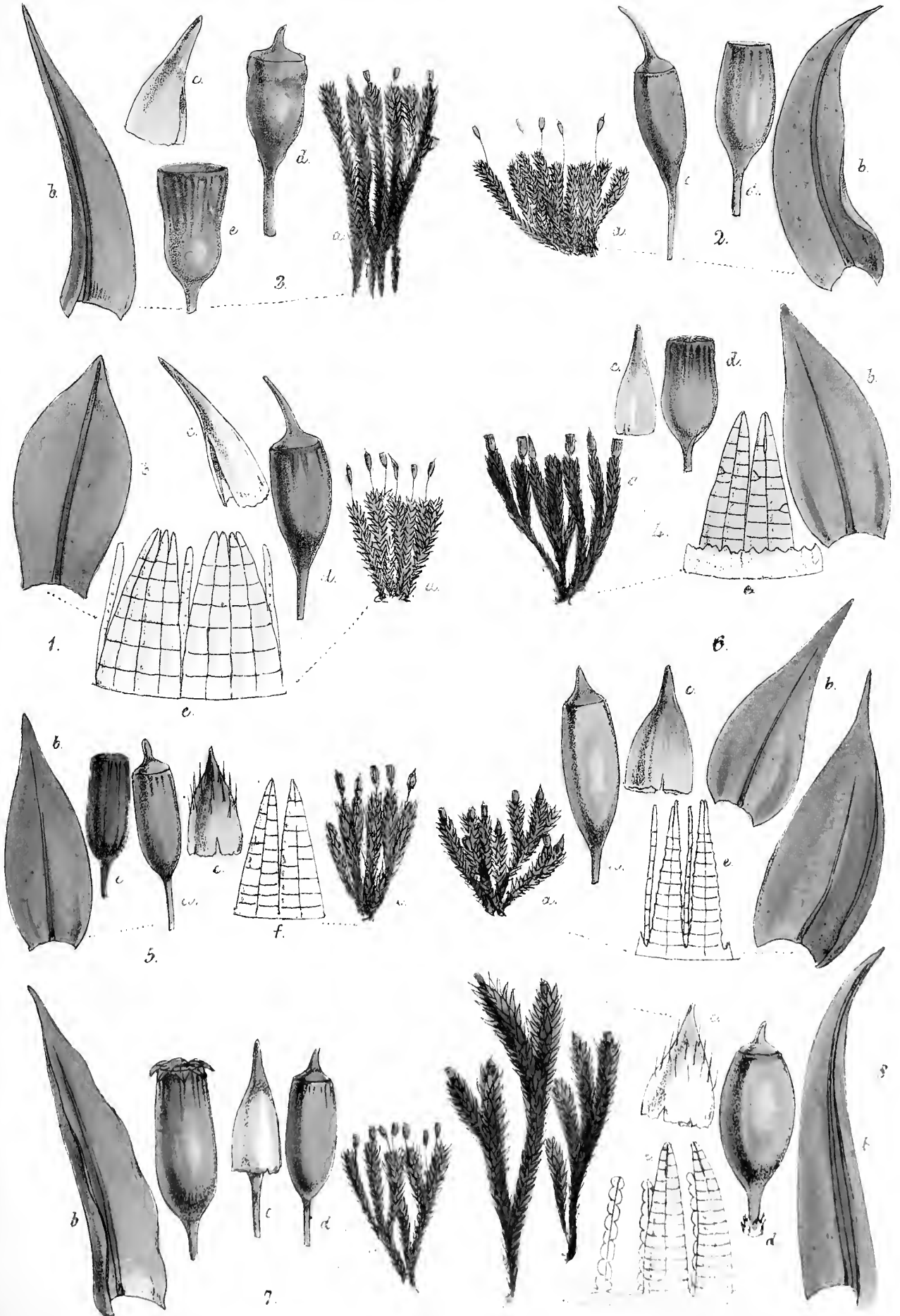
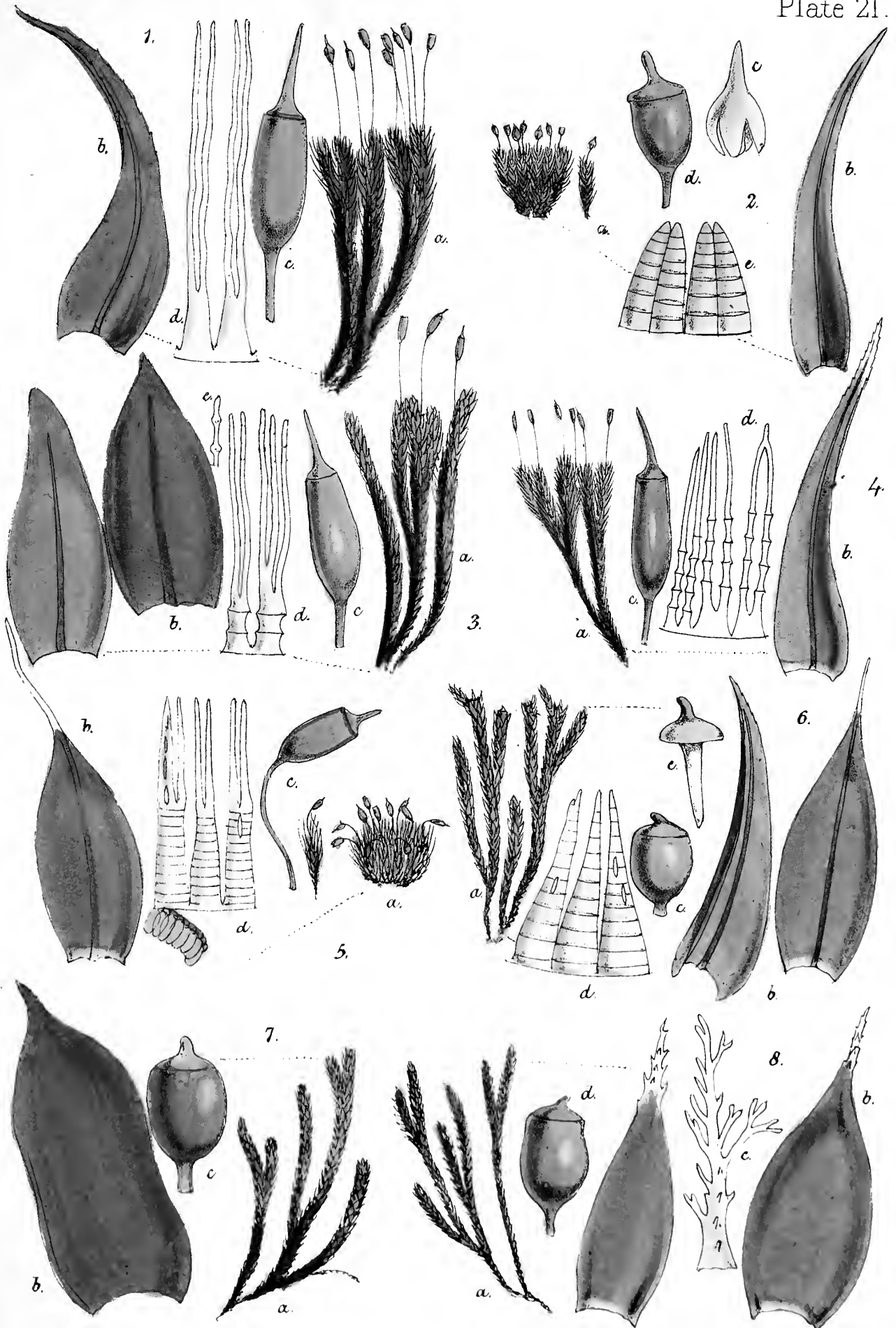






PLATE XXI.

1. *Ptychomitrium polyphyllum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
2. *Glyphomitrium Daviesii*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* veil, magnified (generally plicate).
  - d.* sporangium, magnified.
  - e.* portion of peristome, magnified.
3. *Racomitrium aciculare*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* tip of tooth, more highly magnified.
4. *R. heterostichum*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
5. *Grimmia pulvinata*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, with ring, magnified.
6. *Schistidium apocarpum*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* sporangium, magnified.
  - d.* portion of peristome, magnified.
  - e.* columella, with lid attached, magnified.
7. *Hedwigidium imberbe*.
  - a.* plant, nat. size.
  - b.* leaf, magnified.
  - c.* sporangium, magnified.
8. *Hedwigia ciliata*.
  - a.* plant, nat. size.
  - b.* leaves, magnified.
  - c.* tip of leaves, magnified.
  - d.* sporangium, magnified.



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Vincent Brooks, Imp.







PLATE XXII.

1. *Encalypta vulgaris*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* veil, magnified.

*d.* sporangium, magnified.

*e.* tip of axis, with archegonia, paraphyses, and vaginula, magnified.

2. *Cinclidotus fontinaloides*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* veil, magnified.

*d.* sporangium, magnified.

*e.* portion of peristome and tip of columella, round which the tips of some of the teeth are wound, magnified.

3. *Tortula muralis*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium and veil, magnified.

*d.* sporangium with lid, magnified.

4. *T. ruralis*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium, magnified.

*d.* peristome, magnified.

*e.* part of peristome, more highly magnified.

5. *Leptotrichum homomallum*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium, magnified.

*d.* part of peristome, magnified.

6. *Didymodon flexifolium*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium, magnified.

7. *Distichium capillaceum*.

*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium, magnified.

*d.* part of peristome, magnified.

*e.* ring, magnified.

8. *Desmatodon nervosus*.

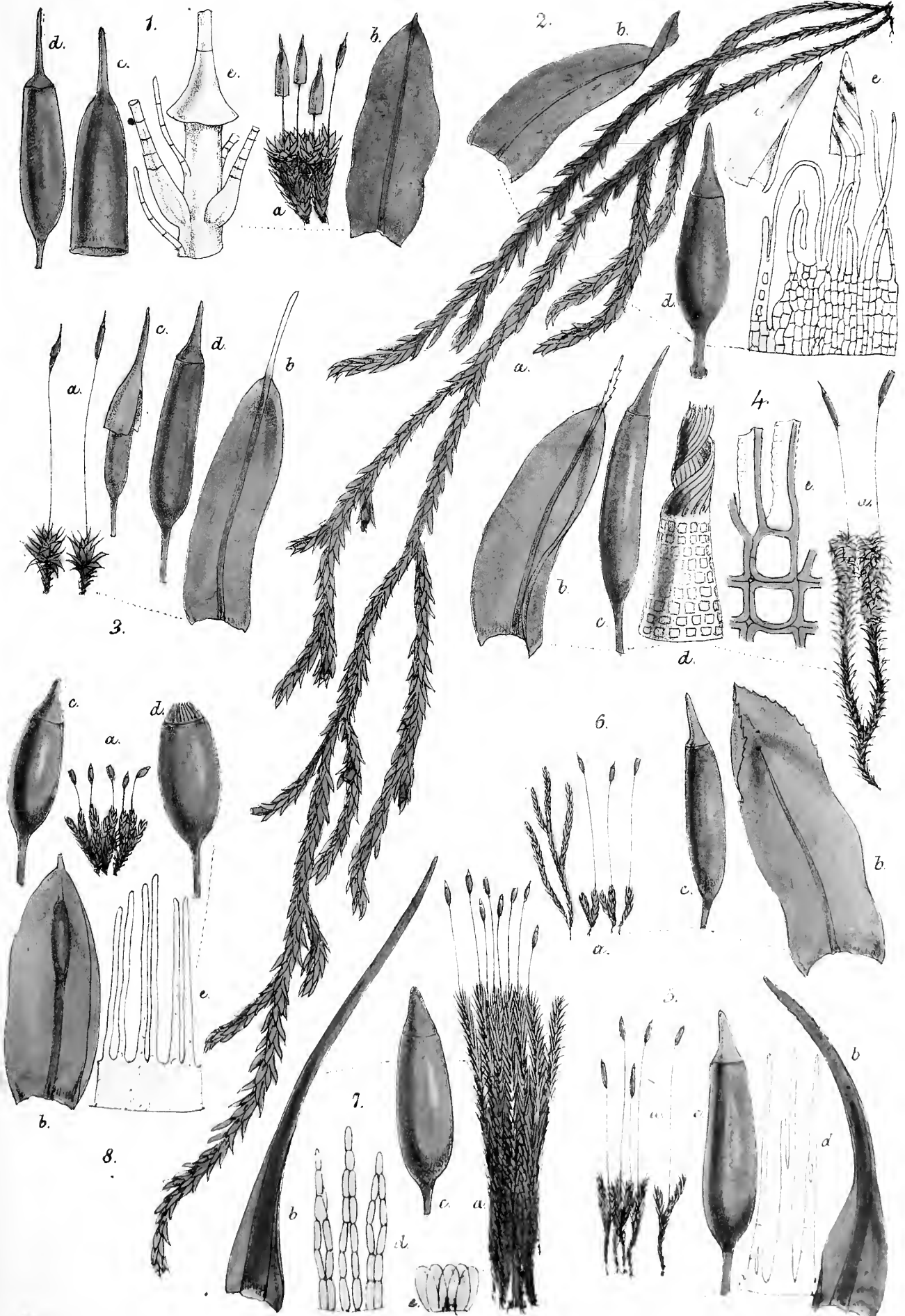
*a.* plant, nat. size.

*b.* leaf, magnified.

*c.* sporangium, magnified.

*d.* sporangium without lid, magnified.

*e.* portion of peristome, magnified.



W. Fitch, del. et lith.

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PLATE XXIII.

1. *Anacalypta lanceolata*.

- a.* plant, nat. size.      *c.* sporangium, magnified.  
*b.* leaf, magnified.      *d.* sporangium without lid, magnified.  
*e.* portion of peristome, magnified.

2. *Pottia crinita*.

- a.* plant, nat. size.      *c.* young veil, magnified.  
*b.* leaf, magnified.      *d.* sporangium, magnified.  
*e.* follicle of *P. cavifolia*.

3. *Pottia Heimii*.

- a.* plant, nat. size.      *b.* leaf, magnified.  
*c.* sporangium, magnified.

4. *Campylopus flexuosus*.

- a.* plant, nat. size.      *c.* veil, magnified.  
*b.* leaf, magnified.      *d.* sporangium, magnified.  
*e.* part of peristome, margined.

5. *Ceratodon purpureus*.

- a.* plant, nat. size.      *c.* sporangium, magnified.  
*b.* leaf, magnified.      *d.* part of peristome, magnified.  
*e.* tip of tooth, more highly magnified.

6. *Leucobryum glaucum*.

- a.* plant, nat. size.      *c.* tip of leaf, magnified.  
*b.* leaf, magnified.      *d.* sporangium, magnified.  
*e.* part of peristome, magnified.

7. *Dicranum scoparium*.

- a.* plant, nat. size.      *b.* leaf, magnified.  
*c.* part of peristome, magnified.

8. *Dicranella heteromalla*.

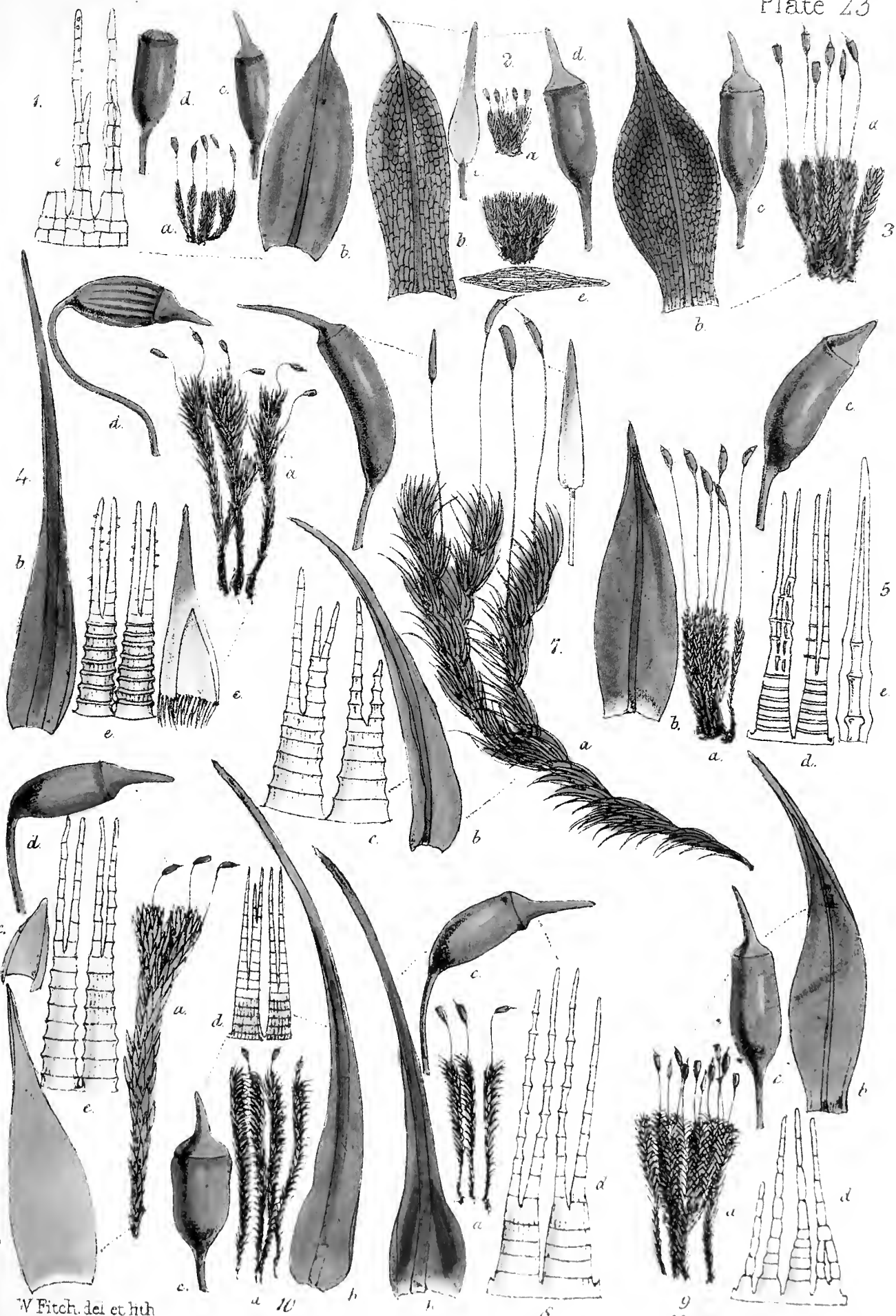
- a.* plant, nat. size.      *c.* sporangium, magnified.  
*b.* leaf, magnified.      *d.* part of peristome, magnified.

9. *Cynodontium Bruntoni*.

- a.* plant, nat. size.      *c.* sporangium, magnified.  
*b.* leaf, magnified.      *d.* part of peristome, magnified.

10. *Arctoa fulvella*.

- a.* plant, nat. size.      *c.* sporangium, magnified.  
*b.* leaf, magnified.      *d.* part of peristome, magnified.



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Vincent Brooks Imp







PLATE XXIV.

1. *Blindia acuta*.

- a.* plant, nat. size.                      *d.* sporangium, magnified.  
*b.* leaf, magnified.                      *e.* sporangium without lid.  
*c.* tip of leaf, magnified.              *f.* part of peristome, magnified.

2. *Seligeria calcarea*.

- a.* plant, nat. size.  
*b.* plant, magnified.  
*c.* leaf, magnified (broader and more acute than usual).  
*d.* sporangium, magnified.  
*e.* portion of peristome, magnified.

3. *Brachyodon trichodes*.

- a.* plant, nat. size.                      *e.* sporangium, magnified.  
*b.* plant, magnified.                      *f.* lid, magnified.  
*c.* leaf, magnified.                      *g.* part of peristome, with ring,  
*d.* veil, magnified.                      seen from within, magnified.

4. *Campylostelium saxicola*.

- a.* plant, nat. size.                      *c.* leaf, magnified.  
*b.* plant, magnified.                      *d.* part of peristome, with ring, mag.

5. *Rhabdoweissia denticulata*.

- a.* plant, nat. size.                      *c.* sporangium, magnified.  
*b.* leaf, magnified.                      *d.* part of peristome, magnified.

6. *Weissia controversa*.

- a.* plant, nat. size.                      *c.* sporangium, magnified.  
*b.* leaf, magnified.                      *d.* part of peristome, magnified.

7. *Hymenostomum squarrosum*.

- a.* plant, nat. size.                      *c.* leaf, magnified.  
*b.* plant, magnified.                      *d.* sporangium, magnified.  
*e.* mouth of sporangium, magnified.

8. *Phascum bryoides*.

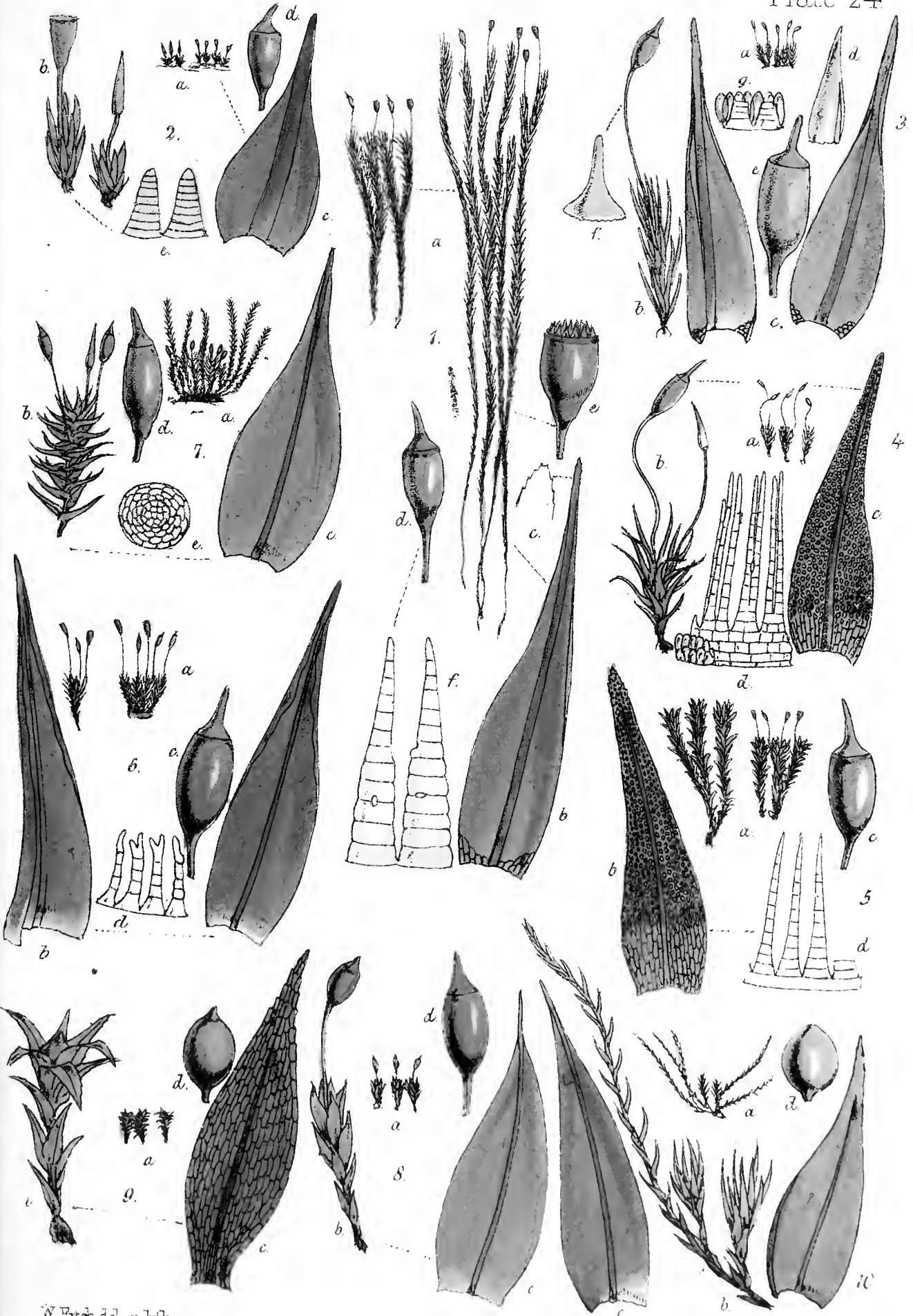
- a.* plant, nat. size.                      *c.* leaf, magnified.  
*b.* plant, magnified.                      *d.* sporangium, magnified.

9. *Physcomitrella patens*.

- a.* plant, nat. size.                      *c.* leaf, magnified.  
*b.* plant, magnified.                      *d.* sporangium, magnified.

10. *Archidium phascoides*.

- a.* plant, nat. size.                      *c.* leaf, magnified.  
*b.* plant, magnified.                      *d.* sporangium, magnified.





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